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A REPORT TO THE CONGRESS ON POLLUTION OF NAVIGABLE WATERS OF THE U.S. BY WASTES FROM WATERCRAFT

Federal Water Pollution Control Administration
Washington, D.C.

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Wastes from Watercraft

A Report to the Congress

U. S. Department of the Interior
Federal Water Pollution Control Administration

June 30, 1967

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A Report To The Congress

on

POLLUTION OF NAVIGABLE WATERS OF THE U. S.

by

WASTES FROM WATERCRAFT

Prepared in Consultation with:

the Department of Defense

the Department of Transportation

the Department of Commerce

the Department of Health, Education, and Welfare

UNITED STATES DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

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TABLE OF CONTENTS

PAGE

I INTRODUCTION 1

II SUMMARY AND CONCLUSIONS 4

III RECOMMENDATIONS - PROPOSED PROGRAM FOR CONTROLLING POLLUTION 7

IV THE PROBLEM 13

  1. Dimensions 13
  2. Sources 15
  3. Effects 18

V POLLUTION CONTROL MECHANISMS 22

VI LAWS AND REGULATIONS 30

VII ON-GOING ACTIVITIES 34

APPENDIX

EXHIBIT

On-Going Activities 1

Laws and Regulations 2

Basis for Computing Wastes Loads 3

Members of Interdepartmental Committee on Water . Pollution from the Operation of Vessels 4

Bibliography 5

LIST OF TABLES

	EXHIBIT	PAGE
Summary of State Laws and Regulations Relating Specifically to Watercraft Disposal	2	5 6
Waste Loads of Watercraft - Human Wastes . . .	3	2
Numbered Recreational Watercraft	3	4 5
Recreational Watercraft Statistics	3	6
Watercraft Having Sanitary Facilities . . . . . (Estimated from Industry Data)	3	7
Watercraft Having Sanitary Facilities . . . . . (Estimated from Coast Guard Data)	3	7
Arrivals and Departures of Ocean-Going Watercraft at Major Ports of the United States	3	17 18

I. INTRODUCTION

From the early days of our history to the present, our navigable waters have served functions essential to the Nation's safety and economic well-being. Our bays and harbors, our Great Lakes, and our coastal and inland waterways are visited and traversed daily by many thousands of commercial vessels, foreign and domestic, from ocean liners to tankers to barges to fishing boats. Naval vessels cruise these waters, as do ships of the Coast Guard, the Corps of Engineers, and other public agencies. A veritable armada of recreational watercraft of all conceivable sizes also plies these waters - impressive evidence of our affluence and prosperity.

As in other spheres of American life, the achievement of affluence and prosperity has not been without expense to the quality of our natural environment. This report to the Congress will show that the threat to our navigable waters through pollution from vessels of all descriptions is formidable, and, above all, needless. The report will also show that the means to stop this degradation and to begin enhancing this resource over the total range of beneficial public uses, are either in hand or can be secured through the additional legislative and other measures which are recommended.

In the light of the Nation's new resolve to restore and enhance the quality of our water by rendering harmless the wastes which issue from our cities, towns, and factories, we cannot afford to ignore the wastes which issue from our waterborne vessels. Indeed, logic alone demands that both efforts proceed in tandem. The ports, bays, harbors and channels which see heavy vessel traffic usually are located in areas of heavy population concentrations. It makes little sense to expect cities and industries along these waters to clean up their own waste discharges only to have the water remain polluted by the sewage, oils, litter, bilge water, ballast water, wash water, and other polluting substances discharged from vessels.

Harbors, bays, lakes estuaries and other heavily used navigable waters differ, of course, in their physical and hydrographic characteristics, and, in turn, in their characteristics from the pollution control standpoint. A narrow-necked harbor, for example, may vary greatly from a relatively open bay or a wide estuary in terms of capacity to assimilate polluting substances without adverse consequences to other beneficial uses. In given areas, therefore, vessel pollution may assume critical importance at an early stage; in other areas vessel pollution may be hidden by other discharges or dispersed by hydrographic characteristics so that it appears to be less critical. Because of a vessel's ability to move freely into critical water areas and the action programs being carried out under the Water Quality Act of 1965 and the Clean Water Restoration Act of 1966 to clean up other pollution sources, vessel pollution should receive prompt attention.

Owing to the wide variations in physical, hydrographic and other characteristics of navigable waterways, including use patterns and pollution experience, it was possible to estimate only in very general terms the total cost of equipping American vessels to prevent pollution of our navigable waters. While it is reasonable to postulate that the economics of particular circumstances must play a role in the rate of compliance with laws and regulations enacted and implemented, there can be no room for doubting the Nation's resolve to proceed with deliberate speed.

Our cities and industries have been asked to incur the costs necessary to comply with the provisions of the Federal Water Pollution Control Act. Executive Order 11288 provides that the Federal Government clean its own house as well. Since there is no rationally defensible conceptual difference between the deliberate discharge of polluting wastes from a municipality or a factory, and the deliberate discharge of polluting wastes from a vessel, the philosophy of stopping deliberate, man-caused pollution at the source -- expressed both in law and Presidential utterance -- must apply as well to all vessels using America's navigable waters, public or private, domestic or foreign. And the costs necessary to restore the quality of our waters must be incurred accordingly. Studies now on-going or proposed will go far to reveal expenditure patterns necessary to that end.

This report reflects the best data and information which could be assembled in the time available. The discussion of oil pollution from vessels has been restricted to general considerations. A full investigation of the many facets of pollution associated with the discharge of oil and oily materials is presently underway and will shed light on all dimensions of this problem. This investigation, co-chaired by the Secretaries of the Interior and Transportation, was ordered by the President following the Torrey Canyon disaster earlier this year. Findings, recommendations and suggested legislation are expected to be set forth on conclusion of the joint study by early fall of 1967.

The basic charge of the Congress to investigate and report on vessel pollution in the navigable waters of the United States was contained in the Clean Water Restoration Act of 1966. The specific language is as follows:

> *"Section 17. The Secretary of the Interior shall, in consultation with the Secretary of the Army, the Secretary of the department in which the Coast Guard is operating, the Secretary of Health, Education, and Welfare, and the Secretary of Commerce conduct a full and complete investigation and study of the extent of the pollution of all navigable waters of the United States from litter and sewage discharged, dumped, or otherwise deposited into such waters from watercraft using such waters, and methods of abating either in whole or in part such pollution. The Secretary shall submit a report of such investigations to Congress, together with his recommendations for any necessary legislation, not later than July 1, 1967."*

The findings and recommendations growing out of this investigation are set forth in the succeeding chapters of this report. Recommendations for necessary legislation have been compiled and are being submitted to the Congress simultaneously.

II. SUMMARY OF FINDINGS

The problem of pollution from watercraft is both widespread and varied. In a sense, it is also a new problem. It is new because watercraft--particularly recreational boats--have increased to such numbers that their once negligible wastes are becoming a significant factor in the overall pollution picture. And it is new because it has been caught up in the mounting public concern about all forms of pollution.

The problem is widespread because vessels and boats frequent all navigable water areas of the Nation and may trigger local pollution at any point along their path. Pleasurecraft congregating for weekend fun may suddenly impose a load of untreated wastes, equivalent to those of a small city or town, on the waters they use. Luxury liners are equipped with the finest sanitary facilities for every cabin and many other devices that mean greater volumes of wastes to be disposed of.

The pollution problem from watercraft is as varied as the products and technologies of our times. Nuclear-powered ships and submarines are one example. Tanker and cargo vessels are larger than they used to be. They carry more varied cargoes such as chlorine gas; crude oil and its refined products of gasoline or oils; organic chemicals and pesticides which if spilled, persist for long periods of time to poison fish and change the whole ecology of a river, estuary, or lake. Commercial fishing vessels are now designed as floating canneries; both canning wastes and the sanitary wastes of the crew are discharged on-site, wherever they operate.

In summary, the study of pollution resulting from the use of watercraft in navigable waters of the United States has produced the following findings:

1. Approximately 46,000 documented commercial vessels, 65,000 non-documented commercial fishing vessels, 1,500 Federal vessels, and 8,000,000 recreational watercraft use the navigable waters of the United States. In addition, about 40,000 foreign ship entrances are recorded each year for these waters.

2. Vessel sewage is discharged to waters of the United States from commercial vessels, both U. S. and foreign, at a rate (occupancy rate) equivalent to 199,000 persons; from

Federally operated watercraft, 144,000; and from the 1,300,000 recreational watercraft which are toilet-equipped, 170,000. While this estimated total waste discharged from all watercraft thus approximates the wastes from a city of one-half million people, it is crucially important to recognize that such an estimate is meaningless in attributing comparative pollutional dimensions. That is, the ratio of the number of pounds of biochemical oxygen demand from vessel pollution to the number of pounds of BOD from all sources cannot serve as an indicator of the comparative seriousness of vessel pollution.

3. Some 279,000 persons serve aboard 1,500 Federally operated watercraft. Generally, these 1,500 watercraft do not have pollution control devices. As in the case of other sources of pollution, the Federal establishment has a special responsibility to show leadership by establishing effective programs to remedy this situation.

4. In most instances, untreated sewage is discharged from watercraft just as it has been since the beginning of navigation.

5. The adverse impact of waste discharges from vessels is most serious on those frequent occasions when such discharges produce a concentration of pollution in confined or heavily used areas. For example, a flotilla of recreational watercraft congregating for a weekend boat-in can easily contaminate the shellfish beds in an estuary or other critical water area. For another example, a foreign-flag ship could discharge ballast water brought in from a badly polluted foreign harbor, thus adding to a port's already massive burden of pollution.

6. Watercraft pollution can be a serious economic and health threat to many water-use areas in the United States. Vessels and boats may defile such critical areas as those used for body-contact water sports, drinking water supplies, shellfish beds, and recreational lakes where organic wastes and nutrients foster algal nuisances and accelerate eutrophication. Such pollution can be grossly offensive and may adversely affect shoreline real estate and other property values.

7. Beyond these most flagrant on-the-scene abuses of the waters, pollution caused by vessels is often transient. Raw sewage and ballast water may be disgorged by a commercial vessel on the high seas today, only to foul the bathing beaches of Florida, or Cape Cod, or Galveston, tomorrow.

8. The pollutants that are discharged from vessels, and which degrade the waters to which they are discharged, include sewage, oils, litter, bilge water, ballast water, wash waters, chemicals, and accidental cargo spills. Sewage may contain dangerous concentrations of pathogenic organisms that cause diseases such as dysentery, shigellosis, typhoid or paratyphoid fevers, gastroenteritis, and infectious hepatitis. Ballast waters may contain oils and may be grossly polluted, dangerous to public health, and highly objectionable.

9. Twenty nine States have laws to regulate vessel discharges, directed generally toward sewage discharges only from recreational watercraft. Twenty one States have no vessel pollution control legislation or regulation. In many States, the adequacy of enforcement is questionable.

10. Federal laws and regulations prohibiting the dumping of litter, sewage, and waste waters in specific locations are intended primarily to prevent impairment of navigation and the spread of communicable disease, animal diseases and plant pests. They are not now wholly effective in preventing water pollution.

11. Devices for on-board holding of sanitary wastes are available and are required on smaller craft in some States; however, their widespread use is dependent on the installation of adequate shoreside receiving facilities in all ports of call. Some devices for adequately treating sanitary wastes on-board are available now while others are in the development and evaluation stage.

12. Adequate shoreline waste treatment facilities to receive, treat, and dispose of wastes from vessel holding tanks and containers are not generally available.

13. Pollution from countless oil spills contaminates our rivers, lakes, estuaries and beaches. At the President's request, a separate special study into all aspects of this multi-faceted threat is now being conducted jointly by the Departments of the Interior and Transportation, with completion expected by early fall of 1967. The present report therefore restricts itself to a brief discussion of oil discharges.

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III. RECOMMENDATIONS

PROPOSED PROGRAM FOR CONTROLLING POLLUTION OF WATERS OF THE UNITED STATES BY WATERCRAFT

The problem of water pollution from watercraft will not be solved by partial solutions and no more than a partial solution can be accomplished by continuing the present approach. At present there are a number of programs designed to control or prevent pollution by wastes from watercraft, such as:

- Twenty-nine states have vessel pollution control laws of varying degrees of effectiveness.
- Twelve states prohibit the discharge of any sewage from recreational craft.
- Several Federal agencies treat wastes from their vessels.
- A voluntary program to treat vessel wastes in the Great Lakes has resulted in approximately 15 percent of American flag lake carriers installing secondary waste treatment plants.

However in relation to the magnitude of the problem all of these efforts are fragmentary. The transient nature of vessel pollution and the great degree of mobility of vessels require the approach to the problem to be coordinated and total if it is to be effective.

The proposed program for the control of pollution from vessels set forth in this report covers four major waste categories: (1) sewage: (2) bilge and ballast waters; (3) litter and related solids: and (4) oil.

1. The control of sewage pollution from watercraft:

Legislation is needed to initiate an effective program for the control of sewage from vessels. It is estimated that control should be fully effective within approximately seven years after enactment of such legislation. The general timing of this program would be such as to be generally correlated with efforts to control other sources of pollution in the Nation's waterways. The program will build upon any present effective efforts to control vessel pollution. During this 7-year period, these efforts should be continued and encouraged.

The proposed program is:

a. Enactment of Federal legislation requiring the Secretary of the Interior to issue regulations setting forth standards applicable to the discharge of sewage from all classes of watercraft which are using the navigable waters of the United States.

The standards would regulate discharges of sewage. They would be established after careful consideration of various factors such as economic costs, types of vessels, and vessel operation patterns. The regulations would prohibit discharges of sewage, under conditions, and at times and locations considered reasonable and appropriate in light of the varied and legitimate uses of the waters.

The standards would consist of treatment and/or effluent specifications for the various classes of watercraft.

b. An evaluation program would be established to examine the effectiveness of a variety of general methods of abatement and determine which methods are appropriate for various classes of watercraft.

In the case of recreational watercraft, the requirement of holding devices would be seriously considered (It is noted that twelve States now prohibit the discharge of sewage from recreational watercraft). It is anticipated that standards would provide for a variety of methods to be used on various classes of larger watercraft such as Federally documented vessels.*

It is expected that proposed regulations setting forth the standards would be issued within 18 months after enactment of the legislation. Before such regulations are effective, industry and interested public and private agencies would have the opportunity to review and comment on such preliminary standards before they are effective.

c. Once the standards have been established, a voluntary program for type testing and certifying proprietary devices to control the sewage discharge to meet the standards would be instituted. This program would involve the development of test procedures by the Secretary of the Interior. Manufacturers using this program would be required to test or have their devices tested in accordance with these procedures. They would then have to submit this test data to the Secretary when requesting approval of a device. The Secretary would run confirming tests either through the Department's own laboratories or by contract with other public agencies or private organizations.

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* Federally documented vessels - watercraft of 5 net tons or more which are registered, documented, enrolled, or licensed under the provisions of Federal law (see 46 U.S.C. 251).

Such devices would also have to be certified by the Secretary of Transportation through the Coast Guard from a safety standpoint. The Coast Guard would be concerned with the design, construction, alteration, and repair of the device, as well as the materials used therein.

Once certified, the manufacturer would be able to sell all devices that conform to the certification as approved devices.

d. Time schedules for complying with the standards would be established under the regulations. The schedule for compliance could vary among classes of watercraft to take into account technical and economic considerations as necessary, and would distinguish between new and existing watercraft. Watercraft which are currently providing treatment conforming to suggested levels in the Handbook on Sanitation of Vessel Construction (USPHS 1965) would be given the longest time period to comply. Short term exceptions to the time schedule could be made when the inequities of a particular situation clearly indicate the need for such exception.

Following the compliance period, any vessel not equipped to comply with the standards would have to notify the Coast Guard before entering United States waters. Depending on the circumstances,such vessels could be required to have all sewage-producing facilities sealed prior to entry into such waters. In such cases, such vessels would be required to use chemical toilets or other holding devices during their stay in United States waters.

Watercraft, such as houseboats and floating dormitories, which are generally stationary would be required to be connected to shoreside facilities that provide secondary or such other degree of treatment as is required for the waters to which the treated wastes are discharged, or provide such treatment on board.

In the case of vessels with holding facilities, at-sea disposal would be permitted as an alternative to pumping to shore facilities. Areas in which such at-sea disposal would be prohibited, however, would be established.

e. A system of inspection of vessels to assure that devices installed are satisfactory and in operating condition would be established. The States would be encouraged to develop adequate inspection systems--particularly for inland and other recreational waters where Coast Guard coverage is not likely to be extensive.

f. All regulations affecting foreign vessels would be coordinated through the State Department and, whenever practicable, developed in consultation with the appropriate international organization, such as the World Health Organization or the Intergovernmental Maritime Consultative Organization to minimize the possibility of international misunderstanding.

As part of the overall program, adequate shore treatment and disposal facilities should be provided at all significant points, such as marinas and commercial ports. Provision of such facilities can best be required and regulated under State law. The Federal Government would provide technical assistance to the States concerning such provisions of facilities. The Public Health Service under its quarantine authority should extend its certification of shore-based servicing areas to include the requirement for sewage receiving and disposal facilities in conformance with requirements determined by the Federal Water Pollution Control Administration.

2. The control of ballast and bilge water:

Ballast and bilge water when discharged from watercraft are recognized as potential and, in many cases, actual causes of pollution. The materials causing concern vary widely in character, concentration, and quantity, and their potential effect on receiving waters may be equally varied. Satisfactory regulation of these waste water discharges must consider both the waste water itself and the needed quality of the receiving water.

Legislation should be enacted to provide for regulating the disposal of ballast and bilge waters from watercraft. Any such regulation would be established in conformance with appropriate State and local authorities and would be consistent with water quality standards established pursuant to the Water Quality Act of 1965.

3. The control of litter and other related substances:

Legislation should be enacted to control the discharge from vessels of litter, garbage, sludge, and other related solids into the navigable waters of the United States.

This legislation would authorize the Secretary of the Interior to issue regulations governing such discharges whether the substances originated on board the vessel or were transported thereon. The legislation would not affect the authority of the Secretary of the Army or the Chief of Engineers under such authorities as the Refuse Act (33 U.S.C. 407) and the Act of June 29, 1888, as amended (33 U.S.C. 441-451b) with respect to the issuance of permits to control potential obstructions to navigation.

4. The control of oil discharged from vessels:

The discharge of oil and oily materials from watercraft is a serious pollution problem which has received recent and widespread public attention. The sinking of the Torrey Canyon and oil pollution episodes off the Northeast coast of this country resulted in tragic harm to marine life and waterfowl and did substantial damage to recreational and other facilities. To promote prompt action in preventing similar pollution catastrophes, the President directed a memorandum to the Secretary of the Interior, and the Secretary of Transportation which states in part:

> *"I am asking you to undertake, on an urgent basis, a study to determine how best to mobilize the resources of the Federal Government and the Nation to meet this problem. I would like you to co-chair the project and report to me within ninety days on the steps taken to implement this memorandum with recommendations as to what additional authority is necessary to assure and effective national and international program."*

Accordingly problems concerning oil pollution will be considered by the 90-day study.

5. The control of pollution in the zone contiguous to our territory and territorial sea:

Legislation should be enacted to authorize the Secretary of the Interior to issue regulations governing the discharge from vessels of various substances, including sewage, garbage, sludge, and oil, into the 9-mile Contiguous Zone established by Article 24 of the Convention on the Territorial Sea and the Contiguous Zone.

The purpose of these regulations is to prevent discharges in the zone that may pollute or contribute to the pollution of the waters of the territory or the territorial sea of the United States. As in the case of the navigable waters of the United States, this legislation would not affect the authority of the Secretary of the Army or the Chief of Engineers to issue permits relative to potential obstructions to navigation.

IV. THE PROBLEM

Watercraft discharges may include sanitary wastes, oils, litter, bilge waters, ballast waters, wash waters, chemicals, and a variety of accidental cargo spills. When these materials are deposited in waters which are used for other purposes, they may cause diseases in man, make the water unsightly, and generally lower its utility for other legitimate purposes. In addition, these pollutants may damage or destroy aquatic life, fish, and waterfowl. The many watercraft of all classes which use American waters may deposit varying amounts of these polluting materials, causing local areas of pollution. The ubiquitousness of this problem demands that its dimensions, sources, and effects be further examined.

1. Dimensions of the Watercraft Pollution Problem

Sanitary wastes may contain dangerous concentrations of pathogenic organisms that cause such diseases as dysentery, shigellosis, typhoid or paratyphoid fevers, gastroenteritis, and infectious hepatitis. Such wastes can make waters dangerous for swimming, waterskiing, and other water contact sports, and it can also defile and contaminate shellfish-growing areas. Vessels are highly mobile--recreational watercraft may congregate for a holiday weekend and seriously contaminate a shellfish area, bathing beach, or other critical water use area that was previously uncontaminated.

Sewage, including sanitary wastes and other waste waters, is principally organic material, and its decomposition in water will use dissolved oxygen that must be maintained at levels satisfactory for the existence and propagation of healthy aquatic life. It is rich in nitrogen and phosphorus nutrients, and these promote algal nuisances and surface scums of aquatic vegetation and accelerate eutrophication in lakes and other quiescent waters.

Oil is a serious pollutant whether it is an accidental spill or oil waste waters from ballast tanks or bilges. It can be a fire hazard and can discolor vessels, piers, docks, and other structures at the water line. Oil may contaminate beaches and destroy valuable birds, fish, and other aquatic life. A full discussion of oil pollution dimensions is not included in this report since, as noted above, it is the subject of a special study and report to the President.

Litter is any solid material such as trash, rubbish, dunnage or garbage that may be thrown or otherwise discharged from a boat or vessel. It has been estimated that the average boater contributes about one pound of paper, cans, and bottles, and about one-half pound of garbage per day of active boating. All litter is aesthetically displeasing, and glass and cans are a hazard when deposited on beaches. Garbage will also consume oxygen when decomposing and will add nutrients to the water which stimulate aquatic plants.

Bilge water is the drainage collected in the lower part of a vessel which is derived from the internal drainage of many miscellaneous sources. It may contain lubricating oil leakage from engine rooms and other machinery spaces, and a variety of materials from cargo and other areas. Bilge water may be only seepage water, which infiltrates most vessels, or it may be highly polluted, malodorous, and hazardous to humans. Shigellosis (bacillary dysentery) has been reported to have been transmitted through bilge water discharges.

Ballast waters are taken on-board because of the need to weight a vessel to maintain marine stability. Most merchant vessels are designed with dual service ballast tanks, better known in the trade as "double-bottom" tanks. These tanks are located in the lowest part of the vessel and contain the fuel oil for the voyage, salt water ballast when the fuel is used up, and ballast for stability purposes. The average freighter may carry 1,000 tons of ballast.

In 1964, 50,993 vessels entered through United States Customs, of which 5.234 American flag and 10,632 foreign flag vessels entered "in ballast". Ballast discharges from these vessels are estimated at 16,000,000 tons, or 4 billion gallons of water.

Ballast waters may be grossly polluted, dangerous to public health, and highly objectionable. They may originate from any foreign port in the world and contain hazardous pollutants and disease organisms from that port.

Wash waters arise from cleaning operations in any part of a vessel. Cleaning agents such as detergents may be the major source of pollution in those waters used to clean the vessel's super structure, hull, bulkheads, and decks. Wash waters from engine rooms will normally contain some oil accumulations from leakage in the oil system.

Accidental cargo discharges include any materials in vessel cargos which are spilled or deposited as a result of collisions, groundings, sinkings, and other navigational accidents. Some spillage of this kind may be due to the parting or mishandling of cargo noses, leaking cargo compartments, or similar occurrences. Cargo discharges may cause water for municipal systems to become unfit for human consumption. Fish and other aquatic life may be killed. Water in streams may be contaminated with oily, sticky, dark-colored, or malodorous materials which make these areas unfit for recreation. Beaches may become defiled and require closing.

2. Sources of the Watercraft Pollution Problem

Watercraft operating in American waters number 46,000 documented commercial watercraft, 65,000 undocumented commercial fishing watercraft, 40,000 foreign watercraft, 1,500 Federal watercraft, and 8,000,000 recreational watercraft. The documented commercial watercraft include 16,000 merchant marine vessels, 3,900 towboats, 2,000 tankers, 4,000 tugs, and 209 domestic shipping vessels used on Great Lakes. Military and other Federal watercraft include 700 naval vessels based in United States ports, 404 U.S. Coast Guard vessels, 321 Corps of Engineers watercraft, 167 Maritime Administration vessels, and a smaller number of ships operated by other departments and agencies of the U.S. Government.

Of the 8,000,000 recreational watercraft, an estimated 1,300,000 are equipped with toilet facilities. This huge fleet is served by some 5,500 marinas and uncounted private slips and docking facilities located in almost all waters of the United States.

The quantities of sewage, litter, and garbage that may be discharged is directly related to the number of watercraft occupants during a given period. The number of persons occupying watercraft for varying periods can be averaged as an "occupancy rate," which equates occasional occupancy to the equivalent of full-time occupancy.

The occupancy rate of watercraft discharging wastes into United States waters annually from all United States and foreign commercial watercraft is estimated at 199,000 persons; from Federally operated watercraft, 144,000; and from the 1,300,000 recreational watercraft that are equipped with toilet facilities, 170,000. The combined waste discharges from all watercraft approximates the raw wastes which are discharged by a city with a population of 500,000, such as Cincinnati, Buffalo or San Diego. The basis for computing waste loads is detailed in the Appendix, Exhibit 3.

Commercial watercraft from all nations call at American ports. They carry both passengers and cargo and may remain in any given port of call for a few hours only or for many days. Between their entrance and clearance through American customs, they may call at one or many ports. During their stay in United States waters, almost all of them practice over-the-side disposal of sewage.

Of 209 commercial watercraft operated by 29 American companies on the Great Lakes, only 40 are now equipped with sewage treatment devices while only 7 more are scheduled to be equipped in the next 2 years. Estimating an average crew of 35, the sewage from these source is equivalent to 6,000 persons. In 1966, 3,374 foreign watercraft entered the Great Lakes, but there is no information available on the waste treatment devices these vessels carried.

Since the St. Lawrence Seaway is open only 240 days a year, assuming an average stay of two weeks for foreign vessels, an average 196 would be on the Lakes at one time. The daily pollution potential from these vessels is about 8,000 people.

Federal watercraft constitute a separate category because of their special mission. The Federal Government has a specific obligation to reduce the pollution from these vessels and also to demonstrate leadership in correcting the general problems of watercraft pollution.

Of the 700 U.S. Navy vessels operated in United States waters, only a few thus far are equipped with sewage treatment devices. Of the 325 U.S. Coast Guard watercraft operating wholly in United States waters that have toilet facilities aboard, 100 are equipped with sewage treatment units. Of these, three are aerobic plants, 20 are pressure operated macerator-disinfectors and the rest are hand pump macerator-disinfectors. Only one of the 80 ocean-going Coast Guard vessels is equipped with sewage treatment facilities. The Corps of Engineers has equipped, or is in the process of equipping, all of its vessels with sewage treatment devices.

None of the vessels owned by the Maritime Administration, which were hurriedly withdrawn from the mothball fleet and pressed into service to meet the immediate Viet Nam needs of the Military Sea Transport Service (MSTS), is equipped with sewage treatment devices.

Recreational watercraft comprise the largest number of watercraft of any category, far exceeding all government-owned and commercial vessels combined. One detailed study of the movements of recreational watercraft in and out of marinas recorded 6,830 trips by boats greater than 15 feet in length. On these trips, 24,459 passengers were carried, and the crafts remained away from port for a total of more than 38,600 hours. From this study it appears that the average recreational watercraft carries 3.59 passengers, is away from port 5.66 or more hours per trip, and results in an occupancy rate of 20.3 man-hours per trip.

An average rate of 2 1/2 uses per week for these boats during a 22-week boating season appears reasonable. This usage rate is conservative since it does not take into account day or overnight stays aboard watercraft in port or the extended boating season of the southern United States. If the 1,300,000 recreational watercraft with toilet facilities are used at this rate, it would result in an average occupancy rate for all recreational watercraft of 170,000 man-years per year, comparable to the population of a sizable city. Use of recreational watercraft tends to be concentrated on weekends, holidays, and during vacation periods.

Houseboats, or floating houses, are used part or full time in many areas of the country. For example, there are approximately 1,200 floating homes in the States of Idaho, Washington, and Oregon, with an estimated combined population of over 2,000 persons. Most of these discharge untreated wastes into the waters on which they are moored. There are 645 houseboats in Oregon, located primarily in the Portland area on the Willamette and Columbia Rivers, and on Howard Prairie Reservoir. Washington has an estimated 525 houseboats, of which approximately 500 are in the Seattle area on or near Lake Union and 25 located near Vancouver on the Columbia and Lewis Rivers. There are 30 to 40 houseboats on Lake Pend Oreille in Idaho. A study made in the Portland, Oregon area conclusively demonstrated that the discharge of concentrated wastes from these watercraft caused a significant degree of pollution.

3. Effects of the Problem

Pollution is the addition to water of any material that changes its quality, thereby making the water less useful for any desired purpose. The ever-increasing movement of watercraft over the navigable waters of the Nation for pleasure or commerce has been accompanied by a corresponding increase in the discharge of wastes materials, both solid and liquid. Pollution has accompanied the greater use of waters.

In view of the large quantities of wastes discharged from land-based sources such as industries and municipalities, the precise effects of watercraft waste discharges are often masked and difficult to measure and document. This is especially true in large harbors or heavily populated and/or industrialized areas. Even for waters used primarily, if not exclusively, for waterborne recreation there is need for additional explicitly documented proof of the effects of wastes discharged from vessels. Nevertheless, the problem exists, and this is widely recognized. Moreover, it is growing in significance. There is much evidence to support these conclusions.

Commercial vessels cause pollution, the extent of which is illustrated by the following examples:

- In 1966, the supervisor of New York Harbor received 556 complaints of water pollution, of which 243 resulted from oil spills or discharges.
- From May 1964 through November 1966, Baltimore Harbor had 19 pollution cases that resulted in legal action, 12 of which involved oil pollution.
- On the northwest coast, commercial traffic in Portland Harbor on the Willamette River totaled 1,747 ships for 1965, each with an average stay in port of 3 days and an average crew of 20. The 1,700 vessel dockings per year contribute approximately 102,000 man-days of sanitary wastes.

As a result of the bacteriological degradation caused, in part, by these vessels, the harbor has been judged unfit for water contact sports by the Oregon State Sanitary Authority, a position fully supported by the Federal Water Pollution Control Administration.

- - At Sacramento, California, washing the cargo holds of a bulk carrier that routinely transports rock phosphate from the Caribbean results in the discharge of about five tons of phosphate with each shipment. Because phosphate is a critical nutrient for plant growth, this discharge can trigger massive growths of algae.

- - Floating canneries for salmon and king crab may become a serious pollution problem in certain areas of Alaska. Salmon canneries operate during the summer months, and king crab canneries are in operation most of the year. In Kodiak, five floating crab canneries dumped all their wastes directly in the harbor in 1967.

- - The Federal Water Pollution Control Administration began a 2-year study in July 1966 to determine the effects of waste discharge from concentrations of naval vessels into the waters of the San Diego Bay. Only preliminary results are available. However, significantly increased sewage bacterial counts in the San Diego waters indicate that the sewage discharged from the anchored naval vessels is carried by the tide for a mile or more. Fecal solids are sometimes seen floating within several hundred yards of anchored vessels.

- - Oil spills and discharges originating principally from commercial watercraft have plagued the Nation's waters for decades. During a 3-year period, 1964 through 1966, the Corps of Engineers reported 1187 spills, with 747 occurring in 1966 alone. Although none has approached the magnitude of the Torrey Canyon spill off the coast of England, even "minor" ones have stained shore lines and beaches, coated floating structures and watercraft, and caused taste and odor problems in municipal water supplies.

Recreational watercraft also discharge wastes into the waters in which they operate - waters that also support other forms of sport such as swimming, waterskiing, and fishing for both fish and shellfish. Although it is difficult to obtain exact proof of pollution from transient watercraft, some information has been developed in several investigations.

- - In 1953, a study was made of Eaton's Neck, a small harbor on Long Island, to determine if pollution from small watercraft, such as cabin cruisers, affects the waters of sheltered harbors and the use of these waters. Pollutional effects which constituted a hazard to body contact sports, such as swimming, and to shellfish culture were found.

- - Kentucky Water Pollution Control Commission personnel counted 110 houseboat cruisers on Dewey Reservoir at the Levisa Fork, of Big Sandy River at one time in 1966. Each boat discharged sewage, making the immediate area potentially hazardous for swimming and for other water contact activities.

- - In 1964 and 1965, a study was made to determine the potential health hazard resulting from waste disposal from watercraft in Selby Bay, Maryland. The evidence showed that watercraft wastes create problems of quality in the waters into which they are discharged.

Many responsible persons, organizations, and governmental bodies have recognized that watercraft are polluting our Nation's waters and that there is urgent need to control this problem. Thirty States have passed State laws regulating or restricting pollution from watercraft. Even though these laws vary widely in their approaches and requirements, they are common testimony to the fact that each of these States considered the problem serious enough to require regulatory action.

Highly respected national groups such as the Association of State and Territorial Health Officers, the Conference of State Sanitary Engineers, the Federal Water Pollution Control Advisory Board, and similar organizations have adopted resolutions pointing up the problem and recommending various remedial actions. The watercraft industries have recognized that the problem requires consideration and have prepared a model ordinance, distributed widely by the Outboard Boating Club of America, and a "Guide for Disposal of Shipboard Wastes" has been prepared by Committee M-17 of the Society of Naval Architects.

Taken collectively, these actions convincingly demonstrate widespread recognition of the problem of pollution of navigable waters by watercraft wastes and the need for a corrective course of action.

4. Some Considerations of Costs and Benefits

It is estimated that 40,000,000 Americans use the 8,000,000 watercraft now in use on the navigable waters of the United States. But these 40,000,000 persons are on-board only a small portion of the time. The actual sewage load discharged from these craft is equivalent to the sewage from an average of 500,000 persons. However, this statistic is or may be used in very misleading ways since this waste is often discharged into critical waters degrading water quality for swimming, fishing, shellfishing, boating or other wateruses.

The installed cost of on-board equipment for properly handling watercraft wastes may vary from $40 to $100,000 per vessel depending on the size, type, mission, and other factors about a particular vessel. Accurate estimates of the cost of equipping all American watercraft to meet pollution control needs cannot be made at this time for many reasons; some of which are: 1) treatment or discharge standards have not yet been established; 2) economies to be realized from volume production of on-board equipment are not reflected in the current price of such equipment, and 3) the costs which may be encountered in retro-fitting existing vessels are not well defined. Based on the numbers of vessels of different classes and the wide range of equipment costs, it appears that the total cost of bringing all existing American watercraft into compliance with the to-be-developed regulations will be in the order of magnitude of $600,000,000. More detailed estimates of on-board costs and estimates of shore-side equipment needs and costs may be made during the evaluative phase of the proposed program.

The benefits to be derived from this program cannot be determined quantitatively, but they will be substantial when viewed in perspective with the on-going water pollution control effort. Watercraft are only one of the many sources of pollution that must be corrected, but this pollution is highly visible and noxious. The benefits of municipal and industrial pollution clean-up could be diminished if not negated by the continued discharge of sewage and other pollutants from watercraft. Such continued discharge of sewage and litter into a bay or harbor could cause the waters to continue to be unsightly and hazardous to humans even after proper control has been achieved for municipal and industrial wastes. The high degree of mobility of watercraft makes virtually all waters subject to pollution, both by local watercraft and by transient craft from far away ports. The payoff from controlling watercraft wastes will be greatest in the many coastal areas where population, boating, recreation and shellfishing are all concentrated. Unless we control watercraft waste discharges, the full benefits from other pollution control investments will not be fully realized.

V. Pollution Control Mechanisms

Sewage equipment for use aboard watercraft is already available in the form of: (1) holding tanks in which to collect sewage to keep it out of the waters; (2) incinerators to burn up wastes so they no longer present a problem; (3) biological treatment facilities to remove the bulk of the solid matter, followed by disinfection and discharge as acceptable effluent; and, (4) macerator-disinfectors that grind up the solids, dose the mixture heavily with a disinfectant, and discharge an effluent intended to present a minimum public health hazard.

Physical characteristics of the equipment play a major role in the choice made for the different kinds of watercraft. Holding tanks, properly designed and installed, are generally suitable for all types, although their weight and size may make them difficult to install in existing larger craft. Incinerators may be used universally, but the fire hazard and power requirements when electrically fired make them less desirable on smaller watercraft and flammable cargo tankers. The weight and size of biological treatment units limit their use to larger vessels only. Macerator-disinfectors have been installed on small to medium sized vessels, i.e., those with crews of 30 to 40. Lack of pollutant reduction along with unreliable disinfection makes their use questionable.

Recognizing the drawbacks of existing equipment, research and testing programs by the Federal Government and private organizations are now directed at the development of more sophisticated devices. The Federal Water Pollution Control Administration is cooperating with the U.S. Coast Guard in further evaluating macerator-disinfectors. The Coast Guard is testing a centrifuge-disinfection system to reduce solids and produce an effluent of a satisfactory bacteriological quality. It is also evaluating an aerobic biological treatment plant with a new method of aeration. The Navy, particularly sensitive to the size and weight of equipment, is investigating a system involving mechanical solids removal, incineration of these solids, and the use of elemental chlorine for disinfection. The Maritime Administration has contracted for the development of a marine oil-water separator and a rapid and automatic means of monitoring oil concentrations in water.

Manufacturers of waste treatment equipment are also developing, adapting, and perfecting programs.

A major roadblock to these endeavors is the lack of sound operational standards for such devices. Rational development of such standards is proposed earlier in this report, and when implemented, should clear this roadblock so that progress can be made along more clearly defined paths. Since American technology has been able to provide satisfactory waste disposal aboard spacecraft circling the globe for days and weeks, it should certainly be able to develop adequate waste treatment equipment for watercraft.

Following are more detailed descriptions of each type of treatment device. The devices are discussed in the order of their capability to prevent pollution, ranging from holding tanks that do the best job,to less effective devices. Both favorable and unfavorable aspects are discussed.

A holding tank is a closed container for retaining sewage onboard a watercraft until it can be properly emptied, usually into an on-shore sewage receiving facility. As considered here, a holding tank would include chemical toilets, recirculating flush toilets, classic holding tanks, and any variation which simply retains the sewage for future disposal at an appropriate site.

In its simplest form, a holding tank can be a bucket-sized container in which sewage materials are collected and hand-carried ashore for proper disposal of its contents. Larger and more sophisticated holding tanks may be constructed as an integral part of the watercraft. These can serve many sanitary facilities onboard but may require extensive facilities for shore connection in order to empty and clean the tank.

One potentially useful variation of the holding tank is the recirculating flush toilet. This device, which is similar to units presently used aboard most jet aircraft, retains sewage from 80 to 100 toilet usages before it must be emptied. It uses minimum space and has a weight equivalent to about 10 gallons of water. It appears probable that larger versions of this device, capable of retaining the sewage from crews as large as 50 or more persons for periods of 7 to 10 days, could be developed within a relatively short time.

Another variant of the holding tank is the chemical toilet. This device is common at construction projects and in other situations where permanent toilet facilities are impractical. Sewage materials deposited in the chemical toilet are treated chemically to render them innocuous. The materials are retained in the receptacle until it is convenient to empty it.

While chemical toilets are sometimes considered to be inconvenient, they can be fully effective in preventing pollution from human body wastes.

Holding tanks appear to have appropriate application aboard all sizes and types of vessels. They may be found in service on tiny cabin cruisers and giant oceanliners such as the USS United States. Such devices appear to be particularly appropriate for small and medium-sized craft on the inland waterways and lakes where the watercraft's mission does not keep it away from a port facility for prolonged periods of time and where the vessel may frequently contact critical water areas which should be protected from sewage discharges.

Ocean-going vessels also can use holding tanks effectively to prevent the discharge of sewage while in port and within United States coastal waters. In the case of ocean-going vessels which stay in port for only a few hours before returning to sea, it may be possible to operate holding tanks in such manner that a shoreside connection is unnecessary since the sewage could be pumped into the sea in distant off-shore locations.

Except in the case of ocean-going vessels, the use of holding tanks aboard watercraft must be combined with the provision of adequate shore-based facilities to empty them. Unfortunately, shoreside facilities are not generally available to receive the sewage from commercial and larger craft. Twelve States presently prohibit the discharge of sewage from watercraft in some or all parts of the State. Some shoreside facilities exist for emptying holding tanks in these States, but they are only occasionally available in other areas of the country even though they have been developed by the manufacturers of the holding tanks and are generally off-the-shelf items.

Even before shoreside connections are provided for each watercraft, "honey-barges" could circulate in the major harbors to receive sewage from on-board holding tanks in a manner similar to garbage barges, which circulate in many harbors and remove garbage from watercraft. Similarly, in the inland waters fueling barges could be equipped to receive the contents of holding tanks on tow-boats. Also, locks on canals and rivers could be equipped to receive the contents of such tanks while the tow-boat is being moved through the locks.

The advantages of the holding tank are:

- - The device completely prevents the discharge of sewage from a watercraft into the water on which it floats.

- - Holding tanks appear to be adaptable to all sizes and types of vessels.

- - Holding tanks installed in commercial ocean-going vessels could minimize the need for shoreside connection for these vessels.

- - The operation of the holding tank is subject to a minimum of mechanical or human failure.

The principal disadvantages of the holding tank are:

- - Holding tanks are relatively large and heavy, especially when designed for prolonged use.
- - Because of weight and space requirements, holding tanks are usually designed to receive human body wastes only.
- - Shore support facilities are normally essential to the proper operation of the holding tank system,and they are presently not available in adequate numbers.
- - Odor control chemicals may be required for acceptable operation.

The holding tank with its several variations appears to offer the most universally applicable and acceptable solution to the watercraft sewage disposal problem. The long period of time during which this type of device has been in use makes it the most thoroughly tested system available. However, to make it fully effective, the device must be refined, and shoreside service facilities must be installed.

Incinerators have been designed to destroy human body wastes and for other shipboard uses. The heat necessary for an incinerator may be developed from electricity, fuel oil, or liquefied petroleum gas (lpg). This device is presently being used aboard industrial watercraft such as dredges and work boats.

Human body wastes are collected in an incineration cup and subjected to sufficient heat to completely burn or destroy them. When properly operated, these incinerators do not produce a noxious odor or excessive smoke and leave only a small amount of ash residue. This residue can be collected over a period of time and easily transported ashore for proper disposal. Incinerators are commercially available from several manufacturers.

In theory, an incinerator could be installed aboard almost any craft large enough to have an enclosed toilet space. In practice, however, the electrical model can only be utilized where sufficient power is available for proper operation. The fuel oil model is adaptable where suitable fuel oils are used for propulsion power aboard the watercraft. The lpg model appears to have extremely limited application in watercraft service. The use of incinerators for other on-board service, such as litter destruction, is almost completely restricted to major vessels.

The advantages of the incinerator are:

- - Complete prevention of pollution from human body wastes.

- - Lightweight device requiring minimal space.

The disadvantages of the incinerator are:

- - Relatively high power requirements for the electrical model.

- - An increased fire hazard from all models.

- - Application generally limited to human body waste.

Sewage incinerators appear to be completely satisfactory as a water pollution control device where human body wastes must be disposed. Other wastewaters from on-board operations are not effectively treated in them.

Biologic treatment plants similar to those frequently used for land-based sewage treatment have been adapted for vessel use. The most successful of these is the extended aeration activated sludge process. In this process, coarse materials are screened out, organic solids ground into small particles, sewage aerated, sludge settled and returned to the aeration chamber, and the supernatant liquid chlorinated before being discharged.

When properly designed and operated, this type of unit provides secondary treatment for the sewage and is fully comparable to an efficiently operated land-based plant. Attempts have also been made to adapt trickling filter-type biologic treatment to watercraft applications, but with little success. Adaptations and variations of biologic treatment systems are being developed for use on vessels through research programs being conducted by the U. S. Coast Guard and private organizations.

Biologic treatment units are now in use on larger watercraft such as Great Lakes carriers, the Corps of Engineers floating plant, and ocean-going vessels which have the capacity to carry the volume and weight requirements of this type of unit. They appear to be particularly well adapted to the larger vessels, which are required to spend prolonged periods of time away from shoreside facilities and in waters which must be protected from sewage pollution.

The advantages of the biologic treatment systems are:

- - Secondary treatment of sewage is achieved.
- - All sewage generated aboard the watercraft can be adequately treated.

The disadvantages of the biologic treatment units are:

- - The units are relatively large and heavy.
- - The process has not been successfully adapted for vessels with small crews.
- - Proper operation of the unit requires trained personnel.

As pointed out, while this type of sewage treatment device may not be applicable to all classes of vessels, it appears to offer an adequate solution to the sewage disposal problem for larger vessels, such as commercial vessels on the Great Lakes and the Corps of Engineer floating plant in the inland waters, which spend prolonged periods in waters which must be protected.

Maceration-disinfection devices have been developed for disinfecting human body wastes generated aboard watercraft prior to discharging these wastes. In operation, the unit mechanically macerates the toilet wastes, mixes flush water and a disinfection chemical (usually hypochlorite), and retains the disinfected sewage mixture for a brief period before discharging it into the water. The contact time of the disinfection chemical with the sewage may vary from less than a minute to several hours, depending on the design of the unit and the rate of use. As they are normally operated, maceration-disinfection devices do not substantially reduce the biochemical oxygen demand (BOD), suspended solids, or nutrient contents of the sewage before its discharge. The particle size of the macerated sewage is frequently such that it may be readily recognized. Under optimum conditions maceration-disinfection units may achieve the substantially complete kill of coliform bacteria; however, the short contact time between disinfectant and sewage leaves unanswered questions where less easily killed pathogens are concerned. Under less than optimum conditions disinfection becomes erratic.

The relatively small size and light weight of maceration-disinfection units allows them to be installed on virtually every type of watercraft. However, the low level of treatment provided by these units may preclude their use in most waters of the United States when treatment standards for watercraft are established.

Advantages of the maceration-disinfection units are:

- - Small volume and light weight.

- - Relatively easy installation on virtually all types of watercraft.

Disadvantages of the maceration-disinfection units are:

- - Reduction in BOD, organics, suspended solids, and nutrients is not effected.

- - Disinfection of the sewage may be questionable.

- - Identifiable sewage solids are sometimes discharged.

- - Units are more subject to human failure and deliberate tampering, causing them to be easily made inoperative or ineffective.

The presently available maceration-disinfection unit by itself does not appear to offer an adequate level of sewage treatment for general application in waters of the United States.

Other sewage treatment systems include experimental systems now being developed and tested which remove solids from the sewage, disinfect the clarified sewage water, and incinerate sewage solids or store them for shore disposal.

Centrifugation, mechanical solids removal, and microfiltration are among the processes being tested for the solids removal phase. Conventional incineration and submerged combustion are being evaluated as mechanisms for destroying the sewage solids. Elemental chlorine, hypochlorite, iodine, and other chemicals are being evaluated as disinfection agents.

One system using chemical sedimentation, incineration, and elemental chlorine disinfection has been developed under contract for the U. S. Navy and is nearing the full-scale evaluation stage. Another system has been developed by industry using chemical sedimentation, submerged combustion, and hypochlorite disinfection and is now being installed aboard a commercial vessel for a full-scale test. Other concepts are at various stages of development.

The apparent advantages of these systems are:

- - Low weight and space requirements

- - Modest cost per crewman served.

- - Capacity to handle all on-board sewage.

The apparent disadvantages of these systems are:

- - The adequacy and effectiveness of the treatment provided by these devices is not yet known.

Considering the unproven state of these treatment systems, no conclusions can be reached on their acceptability and usefulness.

Although the technology and mechanisms for the control of sewage discharges from watercraft are not perfect and far from being in the final state of development, they are now at least minimally adequate to meet the present needs of water pollution control. Short-term testing and development are needed to establish clearly the levels of effectiveness which can be anticipated from the various mechanisms now available or so close to being developed that they can be critically evaluated.

Over the long-term, additional research is needed to improve present concepts and to develop entirely new ones which may yield better methods. Ideally, treatment devices should require less space and less weight-carrying capacity from vessels on which they are installed. Also, they should be improved to the extent that minimal effort is needed by the watercraft operator to comply with appropriate restrictions.

These long-term goals are commendable and desirable, but the desire for Utopia should not be allowed to becloud and confuse the need for action today. Immediate requirements demand that existing technologies and devices be used to effect a realistic degree of water pollution control from watercraft.

VI. LAW AND REGULATIONS

The complex network of Federal law contains many statutes and regulations which bear on the fringe areas of the watercraft pollution problem. However, no law or combination of laws and regulations appears to face the issues squarely enough to solve the problem completely. In addition to Federal law, the water pollution laws or regulations adopted by 30 states are varied in the degree to which they control waste discharge from watercraft.

The Federal laws and regulations which deal with fragmentary aspects of the watercraft pollution control problem are as follows:

- The New York Harbor Act of 1888 (33 USC-411-451 b) prohibits the discharge of refuse into New York, Baltimore, and Hampton Roads harbors.
- The Refuse Act of 1899 (33 USC-407-409,411,419) prohibits dumping of refuse matter of every kind or description into navigable waters. This Act and the New York Harbor Act of 1888 apply to vessels and shore facilities.
- The Federal Water Pollution Control Act (as amended) (33 USC-466 et seq.) requires the establishment of water quality standards for all interstate waters including a plan of implementation and enforcement for achieving the desired water quality. While water quality standards will impose requirements for the control of all sources of pollution, the extreme mobility of many classes of watercraft demands a more direct approach for effective sewage pollution control. The Act also subjects to abatement pollution of interstate or navigable waters which endangers the public health or welfare.
- The Oil Pollution Act of 1924 (as amended) now prohibits the grossly negligent or willful discharge of oil into or upon the navigable waters of the United States from vessels with certain exceptions. The Administration recently recommended changes to strengthen this Act. Section 211 of the Clean Water Restoration Act of 1966 places administration of the Oil Pollution Act under the Secretary of the Interior.

- The Oil Pollution Act of 1961 (33 USC 1001-1015) implements the provisions of the International Convention for the Prevention of Pollution of the Seas by Oil, 1954, which restricts the discharge of oily wastes within certain international waters.

- Convention on the Territorial Sea and the Contiguous Zone, Article 24, Geneva, 1958, (entered into force September 10, 1964) provides that a coastal State may, in the contiguous zone not more than 12 miles from shore, exercise the control necessary to prevent infringement of customs, fiscal, immigration, or sanitary regulations within its territory.

- Federal Regulation 9 CFR 94.5 prohibits the discharge of garbage containing meats of foreign origin into any territorial waters of the United States.

- Federal Regulation 7 CFR 330,400 requires that foreign garbage arriving in the United States must be disposed of to prevent dissemination of plant pests.

- Federal Regulation 42 CFR 72.121 prohibits the discharge of sewage ballast or bilge waters from all vessels near potable water intakes in the Great Lakes.

- Federal Regulation 33 CFR 401.17, and 401.21 prohibits the discharge of sewage and other wastes near Saint Lawrence Seaway Corporation installation.

- Federal Regulation 36 CFR 3.17 prohibits the draining, dumping, or discharging of wastes or refuse, including human waste, from any vessel into waters which are generally adjacent to Federally owned or controlled areas administered by the National Park Service.

Federal law generally is not directed toward the control of water pollution eminating from watercraft. The above cited acts and regulations clearly cover only fragments of the problem, and in many cases the control of watercraft wastes is incidental to the regulation of other problems. The Oil Pollution Act is discussed elsewhere in this report.

State laws and regulations pertaining to the discharge of pollutants from watercraft vary widely.

- - Twenty-one States do not control pollutional discharges from watercraft.

- - Twenty-nine States have laws and/or retulations controlling one or more facets of pollution from watercraft.

- - Twelve States prohibit the discharge of any sewage from watercraft. This requires on-board holding tanks, incineration, or similar treatment.

- - Fifteen States require only the minimal treatment--maceration and disinfection

- - Four States require approved treatment devices not otherwise specified.

- - Twenty-one States specifically approve holding tanks. Only 12 specifically require such devices.

- - Twelve States approve on-board incinerators.

- - Many States exempt certain waters and/or certain classes of watercraft from control.

This extensive, and at times bewildering, array of laws and regulations can be frustrating, even to watercraft owners who honestly try to operate their craft without causing pollution. For example:

- - A watercraft equipped with maceration and disinfection equipment which meets the requirements of its home State cannot legally transit the waters of a neighboring State which prohibits any sewage discharge.

- - A watercraft equipped with a holding tank to comply with a no discharge requirement may have to empty the tank into the water when visiting a State with no requirements because no shoreside facilities are available.

- - A watercraft equipped with a holding tank may be unable (legally) to empty its tank in a State requiring a macerator-disinfector system because shoreside facilities are not available, and the discharge of untreated sewage is prohibited. Details of legislation appear in the Appendix as Exhibit 2.

The varied regulatory situation outlined above can be compared to the confused situations which existed relative to automobile exhaust and automobile safety. Automobiles and watercraft are similar in that both move freely from State to State, both must comply with such standards as may exist in their home State, both are subject to possible prosecution under the laws of other States if they do not comply with their regulations, and both the automobile and watercraft industries appear to have difficulty in developing the necessary hardware to comply universally with the varied regulations which they experience.

The automobile exhaust emission control problem is being handled by the adoption of Federal legislation and regulations establishing minimum requirements for automobile exhaust control, which can be supplemented by more stringent state requirements. The automobile safety problem has been handled by the adoption of Federal legislation and regulations which set forth Federal standards for selected safety items. The strong parallel between water pollution from watercraft and air pollution from automobiles leads to the conclusion that Federal legislation and control will be necessary to adequately effect a workable pollution control program.

VII. ON-GOING ACTIVITIES

Many agencies--both Federal and private--have on-going activities which bear on, or deal directly with, various aspects of controlling watercraft pollution. Some of these are well advanced while others are in only preliminary phases. A complete view of the watercraft pollution picture requires some discussion of these activities.

Each Agency of the Federal Government has a direct responsibility for water pollution control in accordance with the provision of Executive Order 11288, Prevention, Control, and Abatement of Water Pollution by Federal Activities. This Order directs (inter alia) the head of each department, agency, and establishment to ensure compliance with Section 11 of the Federal Water Pollution Control Act; the Executive Branch of the Government to provide leadership in improving water quality through control of water pollution from Federal Activities; and establishes secondary treatment or its equivalent as the general standard of treatment for Federal facilities. Section 8 of this Order directed the preparation of a report to the President on Water Pollution from the Operation of Vessels which has been completed and used as a major resource document for this report.

In keeping with the spirit of this Order, some agencies have exercised leadership by planning and moving to place sewage control devices on-board all of their vessels. In this regard the Coast and Geodetic Survey and U.S. Corps of Engineers are to be particularly commended for their efforts. The control of water pollution from watercraft is a responsibility which must be faced squarely by each Federal Agency.

The Interdepartmental Committee on Water Pollution from the Operation of Vessels was established under the directives of Executive Order 11288. Section 8 of this Order directed the Secretary of the Interior to prepare a report to the President on water pollution caused by the operation of vessels. This report was to be prepared in consultation with, and with the advice and assistance of, the Secretary of Defense, the Secretary of Treasury (U.S. Coast Guard), the Secretary of Commerce, and the Secretary of Health, Education, and Welfare. The Interdepartmental Committee which is comprised of the designees of the Secretaries and FWPCA functioned to provide this consultation, advice, and assistance.

This committee has discussed the problems of water pollution from watercraft of all classes--recreation, commercial, and Federal--together with the plans of each department to control water pollution from this source. Information on the current status of the plans has been provided by the representative of each department.

The Interdepartmental Committee was continued at the request of the Secretary of the Interior to consult on this report. The counsel, advice, and assistance of the committee members, both as individuals and as representatives of their departments, have played a major role in the development of both the report to the President and this report to the Congress. A list of members of the Interdepartmental Committee appears as Exhibit 4.

The Federal Water Pollution Control Administration, as the principal Federal water pollution control agency, is responsible for administering the major parts of the Federal water pollution control program.

1. The Federal Water Pollution Control Act, as amended, provides for the overall consideration of the control of water pollution, research into the methods of preventing water pollution, establishment of water quality standards for interstate waters, and enforcement actions necessary to ensure compliance with the established water quality standards. The Water quality standards, in accordance with the provisions of the Act, are currently being established for interstate and coastal waters, and, when fully implemented sometime after July 1, 1967, they will provide an additional base from which to attack the problem of watercraft pollution.

2. The Oil Pollution Act of 1924, as amended by the Clean Water Restoration Act of 1966, provides for control of grossly negligent or willful oil pollution from watercraft in navigable waters of the United States. The shortcomings of this Act have been recognized, and action is being taken to rectify them.

Based on the foregoing Acts and Executive Order, FWPCA's interest and activities relative to water pollution from watercraft include considerations of oil pollution, technical assistance to the States, and the testing and evaluation of currently available pollution control devices which may be installed on Federal watercraft. Some of these activities are briefly highlighted and,while they have been useful in our initial assessment of the problem, they must be expanded in coverage and extended in detail as we develop a fully effective program for controlling water pollution from watercraft.

FWPCA's activities which bear on, or deal directly with, the watercraft pollution are:

- - A technical assistance project has been conducted by FWPCA in Oregon to study means for collecting and treating sewage from houseboats and floating boathouses on the Willamette and Columbia Rivers. This project, which has recently been completed, was instituted at the request of the State of Oregon so that the 450 houseboats moored on the State's rivers,remote from sewers,could be brought into compliance with the State's law prohibiting discharge of untreated or improperly treated sewage.

- - In cooperation with the U.S. Coast Guard, FWPCA has tested maceration-disinfection units installed on board U.S. Coast Guard vessels. The results of this extensive testing program have led to the conclusions,discussed elsewhere in this report,that maceration-disinfection units do not provide a satisfactory overall solution to the vessel sewage disposal problem.

- - FWPCA has provided technical assistance and advice to the Corps of Engineers relative to its watercraft pollution control program.

- - FWPCA has provided technical assistance to the Navy in evaluating proposals to develop shipboard sewage-treatment equipment.

- - Model legislation regulating pollution from marinas and other watercraft service facilities is presently being drafted and will be submitted for consideration by the States at an appropriate time.

With all of these program activities, FWPCA has only established a base on which to build the next steps in a phased program directed toward control of pollution from watercraft. These steps include the technical evaluation of the effectiveness of pollution control equipment and the establishment of appropriate standards and requirements for installation and operation of the required devices.

The Public Health Service, Department of Health, Education, and Welfare, in discharging its responsibilities under its Quarantine regulations supports an ongoing program covering all aspects of vessel sanitation and operation. The scope of the program covers:

(1) The review of plans for the construction or reconstruction of American flag vessels as well as many Foreign flag passenger vessels.

(2) The issuance of Certificates of Sanitary Construction to those vessels meeting Public Health Service regulations.

(3) Periodic inspection of operating vessels to establish compliance with Public Health Service regulations.

(4) The issuance of Certificates of Sanitation for both American flag and major Foreign flag passenger carrying vessels.

(5) A port and harbor Certification program involving approval of water supply, food sources, refuse disposal, rodent control, and general sanitation.

(6) As the Federal Health Agency, the Public Health Service collaborates closely with the World Health Organization in the application of the International Sanitary Operations and is currently collaborating in the development of a manual of vessel sanitation which will deal with the problems of waste disposal including sewage.

Activities of the Public Health Service relative to vessel and harbor sanitation and FWPCA requirements for watercraft pollution control should be coordinated so that Quarantine activities reflect water pollution control requirements so determined by FWPCA.

The Corps of Engineers, Civil Works, which operates a large number of watercraft, has been a most active Federal agency in seeking a solution to the watercraft pollution problem. The program of the Corps of Engineers has not included any research and development activities, but the agency has attempted to equip Corps floating plant with the best commercially available treatment devices. The Corps' program includes the following:

- - General requirements for treatment systems on board the Corps of Engineers floating plant are:

    1. An aerobic-type system for vessels with a total normal passenger and crew complement of 25 or more.

2. A central maceration-disinfection-type system for normal passenger and crew complement of between 10 and 24.

3. Individually packaged maceration-disinfection, electrochemical, or other approved types for a crew complement between 1 and 9.

- - Using these criteria, a total of 255 vessels have been equipped through fiscal year 1967, at a total cost of $1,116,000 or approximately $5,000 per vessel.

- - An additional 66 installations are programmed by early 1970 when all watercraft owned by the Corps of Engineers will be equipped with sewage treatment systems.

The larger Corps watercraft are all equipped with biologic treatment plants which are capable of effecting secondary sewage treatment. It is believed that these units will meet the regulations for watercraft sewage treatment when such new regulations are promulgated.

The maceration-disinfection units installed on Corps of Engineers floating plant comply with the recommendations of the Public Health Service for vessel sewage treatment. It appears likely, however, that these devices will need to be replaced in a phased and orderly manner when adequate standards are developed for watercraft sewage treatment.

The U.S. Navy has also recognized the need for controlling raw sewage discharges from its vessels. The Navy's sewage pollution control program is:

- - As a matter of policy, the Secretary of the Navy has required that the maximum effort be made to incorporate environmental pollution preventative measures in the basic design of all ships. To this end, he has instructed the Navy to cooperate fully with the Federal Water Pollution Control Administration and the Department of Health, Education and Welfare to comply with published standards and criteria relating to pollution abatement by Federal activities and the directives of Executive Order 11288 for the Prevention, Control, and Abatement of Water Pollution by Federal Activities.

- - The Navy was a participating member of the Inter-agency Committee on Sewage and Waste Disposal from Vessels, sponsored by the U.S. Public Health Service, from May 1960 to February 1964.

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- - Naval ships pose special design problems because damage control features of all systems are important design considerations, and penetration of watertight decks and main watertight bulkheads must be minimized. These special considerations may require unusual treatment arrangements on naval vessels.

- - The naval ship systems command has awarded a three phased contract for the development of a sewage-treatment system, suitable to U.S. Navy requirements, which employs separation of sewage solids, chlorination to disinfect the effluent water, and incineration of the collected solids.

- - The Navy has also been evaluating commercially available maceration-disinfection devices and is considering the installation of this equipment on its small ships and crafts.

- - In new vessel designs, the Navy is reserving space and weight-carrying capability to install sewage treatment devices.

The Navy intends its on-going research and development program to develop sewage treatment equipment to meet the minimum recommendations of the Handbook of Sanitation for Vessel Construction (PHS 1965). The present program of the Navy calls for equipping new vessels as they are constructed and retrofitting older vessels. According to preliminary data, the Navy's treatment system for large vessels provides substantial sewage treatment which, it is hoped,will meet the requirements for watercraft sewage treatment when promulgated.

The U. S. Coast Guard also has an active program for equipping its vessels with sewage treatment devices. The major points of the Coast Guard's program, as reported through the Interdepartmental Committee, are:

- - Approximately 100 of the 400 vessels operated by the Coast Guard are equipped with sewage-treatment devices.

- - The establishment in 1962 of a project in the Coast Guard's Testing and Development Division to develop systems for treating and disposing of watercraft sewage.

- - The initiation of a program for the installation of maceration-disinfection units in small watercraft which use hand-pump sanitary systems.

- - The installation and testing of pressure operated maceration-chlorination units on small watercraft with crews of less than 40 persons.

- - The installation and testing of aerobic treatment units on larger watercraft.

- - Moderately sized holding tanks are installed in new vessels 100 feet long or longer. Sewage from these tanks can be pumped over the side at sea or through deck connections to sewage systems ashore.

- - All new watercraft approximately 100 feet long or less have maceration-disinfection units.

- - The sanitary piping and drains on all new construction are piped to collection points for future installation of treatment units when more advanced designs become available.

- - A development project is underway to develop a more effective aerobic biological treatment plant requiring less space and weight capability than existing plants.

- - A projected development is the testing of a centrifuge-disinfection treatment system.

- - The newly constructed cutter,Hamilton (378 feet in length) is equipped with collecting or holding tanks, and space is reserved for the installation of sewage-treatment equipment.

- - Provision is being made on new dockside construction to provide piping for connection to sewage treatment plants. The new Boston docks are being equipped with sewage-receiving facilities to service holding tanks on Coast Guard watercraft for discharge into Boston's municipal sewers.

The installation of collecting tanks in new construction and the reservation of space and weight capacities for sewage-treatment devices appear to be adequate to meet probable sewage-treatment requirements when they are developed. As with the Corps of

Engineers, maceration-disinfection devices may need to be phased out and replaced with more effective treatment. Every effort should be made to install fully effective treatment devices now to minimize the need for equipment replacement at a future date.

The Maritime Administration, Department of Commerce has initiated provision for and installation of sewage treatment facilities in its new construction program and has sponsored research concerned with the prevention of oil pollution. As reported through the Interdepartmental Committee, its current program consist of:

- - Nineteen aerobic-type treatment units currently being installed in vessels under construction.

- - Provision made for common soil line connections and space for sewage treatment plants on twenty-two vessels under recent construction and for all new construction:

- - A research contract for the development of a marine oil-water separator system employing the principal of static coalescence.

- - A research contract for the development of a rapid and automatic means of monitoring oil concentration in water.

- - A research contract for a compact, low cost oil-water separation system, using standard proprietary equipment, to meet current international oil discharge requirements of 100 parts per million.

- - Requiring, where feasible, the installation of clean water ballast tanks in its new ship construction program.

- - Decision not to install sewage treatment equipment on any reserve fleet vessels now operated by the Military Sea Transportation Service in the Viet Nam supply operation because of the age and interim service of the vessels.

The Maritime Administration's efforts toward the control of oil pollution may form the base for expanded programs in this area.

The U. S. Coast and Geodetic Survey (ESSA) of the Department of Commerce reports through the Interdepartmental Committee that it has equipped all 12 of its vessels with sewage treatment devices of the maceration-disinfection type. Its new survey ship presently under construction will have an aerobic-type treatment unit.

Private groups have voluntarily taken steps to control pollution from watercraft. Some of these steps are:

- Approximately 15 percent of the Great Lakes commercial vessels have installed secondary treatment devices for treating sewage onboard the watercraft.
- Some ocean-going vessels, such as the U.S.S. United States, have installed sewage-holding tanks to permit holding sewage while in port and discharging it at sea.
- Space for sewage-treating equipment has been reserved on some recently constructed ocean-going vessels.
- The recreational watercraft interests have recommended uniform State laws for sewage treatment devices aboard recreational watercraft.
- The American Waterways Operators and the National Association of Tugboat, Towboat, Bargeline Industry, Inc. have established the Naval Architects Subcommittee of the AWO Pollution Committee to consider sewage treatment for these watercraft. This committee's initial report is expected to be available in the near future.
- Committee M-17 of the Society of Naval Architects and Marine Engineers has written a guide for the disposal of shipboard waste which is currently being updated. The current guide, which was prepared in 1962, has served to alert naval architects and marine engineers of the need for sewage disposal consideration and to suggest control mechanisms currently available.

The private sector--watercraft builders, owners and operators, watercraft service suppliers, marina owners, port authorities, and many others--has a special and vital role to play in the achievement of control of watercraft wastes. Many of these groups have already begun to realize their responsibilities and have taken positive steps to discharge them. Many, many more must recognize the problem and take positive action if control of water pollution from watercraft is to be achieved.

Many of the on-going activities cited here are further detailed in the exhibits. They indicate that some progress is being made toward a solution of the problem of watercraft sewage disposal. The progress and constructive efforts outlined here, however, represent only an initial, fragmentary approach to a proper solution.

It is evident from this report that there is widespread recognition of the watercraft pollution problem and that efforts to deal with it are going on at many levels. However, there is no adequate, cohesive program of action which appears likely to provide the control necessary. The key issue is one of leadership--leadership which must be supplied if significant progress is to be made in this area of pollution control. The proposed program is intended to provide this leadership and develop an orderly and effective approach in which all can join to protect and preserve the waters of the United States.

APPENDIX

Exhibit 1
Page 1

ON-GOING ACTIVITIES

Pollution of navigable waters of the United States has been a matter of concern at both Governmental and private levels for years. Programs and activities having as their goal the control of watercraft pollution have been many and varied. The content and character of some of the more important ones are set forth below. The description of the activities of each Federal department has been provided by that department's representatives on the Interdepartmental Committee. Where on-going programs have not required expanded discussion, they have not been reproduced in this section.

The Federal Water Pollution Control Administration and its predecessor agency have been actively concerned with the problems of water pollution from the operation of watercraft for many years. This concern has been evidenced by many FWPCA Programs and activities.

As the Division of Water Supply and Pollution Control of the Public Health Service, the FWPCA participated with other Federal Government agencies in the Interagency Committee on Sewage and Waste Disposal from Vessels. This Committee held five meetings from May 1960 to February 1964. The Committee was principally concerned with the protection of public health from vessel sewage discharges. One product of note from the Committee was a proposal to amend the Interstate Quarantine Regulations to require sewage treatment aboard vessels subject to these regulations. Even though this recommendation has not been formally adopted, it is an initial attempt to come to grips with the problem which has been widely circulated and is the basis for much present-day thinking about on-board sewage treatment.

Beginning in 1963, the FWPCA, then the Division of WS&PC, established the Office of Boat and Marina Sanitation. This Office has exhibited at many marina and boating shows, pointing up the need for clean water and disseminating information to the recreational watercraft public. Working through State officials and interested industry groups, this Office promoted the establishment of uniform State laws regarding sewage from recreational watercraft. Additional efforts have been made to work with and encourage manufacturers of sewage treatment equipment to develop more usable and efficient sewage treatment devices.

Limited studies of the extent and nature of watercraft pollution have been made as a part of several FWPCA projects. More or less detailed studies and estimates of pollution from watercraft have been made in Lake Mead, in Nevada-Colorado; Lake Michigan; Raritan Bay, New Jersey and New York; San Francisco Harbor, San Diego Bay and the Chesapeake Bay, to note a few. Some of these studies developed statistical information and estimates, while others collected chemical and bacteriological data. All of these studies indicate that watercraft do, or have the capacity to, pollute the waters in which they are operated. An interesting example of this point is made on the Great Lakes. Statistical studies there indicate that, on the average, pollution from watercraft constitutes less than 1 percent of the total pollution flowing into the lakes, yet during periods of maximum watercraft use, pollution from this source increases to about 10 percent of the total.

Early in 1966, a project was initiated in conjunction with the U. S. Coast Guard to determine maintenance operability and cost data on certain commercially available macerator-disinfector units. As previous short term tests had indicated that the units effectively disinfected sewage, the primary purpose of this project was to determine operability and maintenance characteristics of the units. After installation on Coast Guard watercraft, an extensive series of laboratory analyses and on-board observations conclusively showed:

1. Sewage was not adequately disinfected in more than one-fourth of the samples tested;
2. Sewage solids frequently were not sufficiently reduced in particle size to prevent recognition;
3. Extraneous fibrous materials lodged on the macerator blades, impeding effective maceration, and
4. Manufacturer's efforts to correct the problems encountered were ineffective.

The FWPCA is also involved in investigations of watercraft pollution. A technical assistance project was undertaken to develop adequate means of collecting and treating sewage from houseboats and floating boathouses on the Willamette and Columbia Rivers. The State of Oregon requested this assistance so that the 450 + houseboats moored on the State's rivers, remote from sewers, can comply with the State's new law prohibiting the discharge of untreated or improperly treated sewage. The study indicated bacterial pollution of waters on which the houseboats are moored which can jeopardize the health of those who enjoy water contact sports such as swimming, etc. The study has been completed and a final report is being prepared.

The FWPCA's most recent project on watercraft pollution also is under the direction of its Pacific Northwest Laboratory at Corvallis. This project is a study of water quality and the effects of watercraft pollution in San Diego Bay. The San Diego Bay Study, initiated during the second quarter of Calendar Year 1966, is just now becoming fully operational. Initial data collected by the project indicate a good correlation between pollution and anchored watercraft. It is planned to determine the effects of watercraft wastes on the waters of the Bay over a period of 18 months. San Diego Bay is a large naval base, and has large recreational watercraft and fishing fleets. During recent years, all domestic sewage has been diverted from the Bay and is receiving proper treatment and disinfection so that watercraft wastes now represent a principal source of pollution.

The Corps of Engineers Civil Works has installed or scheduled installation of sewage treatment systems on all Corps of Engineers-owned watercraft which have installed sanitary facilities. A total of 255 treatment installations have been made or are scheduled for completion in early 1967. An additional 66 installations are programmed for installation in Corps of Engineers' watercraft by early 1970. When the programmed installations are completed, all Corps of Engineers-owned watercraft will be equipped with sewage treatment systems.

Engineers Regulation No. 1125-2-302, dated October 28, 1965, describes the policies and procedures covering the design, acquisition, installation, operation and testing of sewage disposal equipment on all Civil Works-owned floating plants.

The above regulation was based on the Federal Water Pollution Control Act (33 USC 466 et seq.), along with the policies of the Department of Health, Education, and Welfare, at the time of the writing and requires the following:

1. An aerobic type system for watercraft with a total normal passenger crew complement of 25 or more.

2. A central maceration-disinfection type system for a normal passenger and crew complement of between 10 and 24.

3. Individually packaged maceration-disinfection, electrochemical, or other approved (by ENGCW-OS) types shall be used when crew complement is between 1 and 9.

Control criteria, sampling and testing procedures are based on advice and guidance received from the Office of the Surgeon General, U.S. Army, and the Department of Health, Education, and Welfare.

The Corps of Engineers Civil Works has not programmed or accomplished tests or experiments in connection with water pollution. Advice and guidance from the U. S. Army Surgeon General's Office, the Department of Health, Education, and Welfare, the U. S. Navy, Federal Water Pollution Control Administration and private industry has been utilized.

The U. S. Coast and Geodetic Survey (ESSA) of the Department of Commerce also operates 12 watercraft which have crews of 9 to 83 persons. Four new watercraft are under construction - one is to be completed in the fall of 1967, two in 1968, and the last in 1969. This number is so small that it is not listed in statistical summaries in this report. All existing watercraft are equipped with macerator-disinfectors for sewage treatment. Three of the new watercraft will also be so equipped. The fourth will have an aerobic type treatment unit. To date no tests have been made of the effectiveness of this equipment after installation.

Exhibit 1

The U. S. Coast Guard initiated a program for control of water pollution from its watercraft in 1962 by establishing a project in the Testing and Development Division to develop a system for treating and disposing of sewage. The initial phases of this program dealt with installation of macerator-disinfector units in hand pump sanitary systems. Since then, macerator-disinfector units have been installed in pressure-operated systems, on small watercraft, and large aerobic units are being evaluated on larger watercraft.

As a result of this program, some provision for treatment to prevent water pollution is being made on new construction, and retrofitting is taking place on some older watercraft. All new watercraft of approximately 100 feet in length or less are equipped with macerator-disinfector units. Larger watercraft are designed with moderate sized holding tanks from which the sewage can be pumped directly over the side when at sea or can be pumped to sewage systems ashore through deck connections. Also, since the sanitary drains are piped to collection tanks, future installation of treatment units can be relatively easily installed, when reliable units of a practical size have been developed. One of the watercraft under construction, the RESOLUTE, 210 feet in length and with an authorized complement of 60 men, is equipped with an aerobic treatment plant. Evaluation of this plant commenced early in Calendar Year 1967.

The Coast Guard is operating approximately 400 watercraft equipped with toilet facilities. Of these, about 100 are equipped with sewage treatment devices. Of these, 3 are experimental aerobic plants; 20 are pressure operated macerator-disinfector units, and the remainder are hand pump macerator-disinfector units.

The Coast Guard was an active partner with FWPCA in the testing of macerator-disinfector units.

Further installations on Coast Guard watercraft will be governed by several factors. Most of the installations to date have been on small watercraft and are relatively inexpensive units that meet generally accepted standards regarding health hazards and esthetic criteria. The remaining watercraft to be equipped will require much larger and more sophisticated units. It is estimated that the cost of retrofitting these watercraft will be in excess of $4,000,000. It is essential, therefore, that the minimal acceptable standards for sewage treatment be established before a program of this scope is continued. Additionally, further progress must be made in the development of treatment plants of a practical size and weight for shipboard installations. Also, such plants must be thoroughly tested with regard to efficiency, reliability and maintainability.

Retrofitting older watercraft is difficult. Available space is at a premium, and additional weight is, in many cases, intolerable. Rerouting of sanitary systems will be costly as well as undesirable from the standpoint of damage control. The ultimate solution for these watercraft may

Exhibit 1

well be in the installation of holding tanks and pumps for transfer to dockside connections or barges. Dockside sewer connections are practically nonexistant today, and this poses a particular problem for the Coast Guard, since many piers used by Coast Guard watercraft are leased rather than Coast Guard owned. New docks and piers for the Coast Guard will have piping arranged for discharge of holding tanks contents to adequate sewage treatment plants preferable municipally operated.

As an early step in the U. S. Coast Guard's sewage treatment development program, two commercially available macerator-disinfector type sewage treatment plants were procured from the manufacturer for test and evaluation. The plant consists of a control panel, holding tank-macerator, disinfecting agent, injection pump, and storage tank. This system is designed to operate automatically with pressure operated sanitary systems. It is primarily an enlarged version of the smaller macerator-disinfector units which have been successfully used with the hand pump sanitary systems on small boats.

The principle of operation is primarily one of macerating the sewage to reduce particle size to facilitate disinfection and the introduction of a disinfection agent, i.e., a hypochlorite solution. These units have been installed and are currently undergoing evaluation.

To date, the Coast Guard feels that these units are satisfactory for a small watercraft equipped with a pressure operated sanitary system with a limited number of facilities, and for larger ships where only one or two facilities are to be connected to the treatment system. They are to be further evaluated and tested. In particular, it is desired to determine expected life of the various components and the minimum treatment necessary to produce a satisfactory effluent.

The two larger aerobic biological sewage treatment plants which were procured for an evaluation of this type of sewage treatment on ships have been installed on 180 foot buoy tenders. One was installed on the CGC SASSAFRAS. These were prototype units developed by the manufacturers for shipboard installation. While both were of the aerobic biological type treatment plant the means by which treatment is obtained is not the same. One depends primarily upon extended aeration, while the other uses aeration followed by a trickling filter stage to obtain the aerobic action. The primary purpose of these installations was to determine the feasibility of operation in a shipboard environment, in particular, the effect of agitation due to ship motion upon the aeration and settling tanks and flow rates and the effect of salt water being used as a flushing medium on the aeration and trickling filter treatment. The installation on the SASSAFRAS has been operated with only a few minor mechanical problems. Preliminary evaluations have been completed on both aerobic treatment units and neither is satisfactory. While the installation on the SASSAFRAS has been mechanically satisfactory, it has not achieved the BOD and suspended solids reduction which would be expected from this equipment. The other was a trickling filter system installed aboard the CGC SWEETGUM. This one has not been operating satisfactorily as the result of mechanical and design problems. It has been recommended that this unit be removed unless the manufacturer makes proper correction of the equipment.

Practically speaking, the weight and space requirements of the aerobic biological plants currently installed are excessive and severely limit their potential utilization in a shipboard environment. In an attempt to develop alternate solutions to the problem of treating shipboard sewage, two developmental projects have been established at the Coast Guard Field Testing and Development Center.

One project is testing a centrifuge-disinfection sewage treatment system. The principle of this system is to pass the raw sewage through a centrifuge, producing a dry cake which could be incinerated and a liquid containing dissolved solids and solids in colloidal suspension which could be disinfected and discharged overboard. The advantage of this system over the macerator-disinfector is that by removing and incinerating the suspended solids, approximately a 50% reduction in the biochemical oxygen demand can be obtained.

In addition, the effluent from the centrifuge will contain only solids of micron size and the utilization of chlorine should be significantly improved, thereby reducing the amount required. This equipment is to be set up the latter part of the summer of 1967. Test results are expected to be available the latter part of the same calendar year.

The second project is evaluating an aerobic biological plant which is based upon extended aeration. This plant differs in concept from those previously evaluated in that aeration is obtained through the process of aspiration rather than bubbling compressed air through the liquid sewage in an aeration tank. Initially, the aspiration method indicates that much smaller bubble size is obtained and a greater portion of the oxygen is used to satisfy the oxygen demand of the waste than is the case with the diffused air systems. This results in a more compact package since the aeration tank may be reduced in size without loss of efficiency. Testing is essentially complete and indicates that the plant provides at least an 80% reduction in the biochemical oxygen demand of sewage. A unit is to be purchased and installed onboard a watercraft.

The Maritime Administration, Department of Commerce, has actively participated on the National Committee for the Prevention of Pollution of the Seas by Oil since its inception and upon request of the group, furnished an advisor for the International Conference on the Prevention of Pollution of the Seas by Oil, London, 1962. This resulted in revising and updating the 1954 Convention and the ultimate ratification of the 1954 Convention; also the introduction of implementing legislation to permit the work of the Conference to be fully effective in this country.

Exhibit 1

The Maritime Administration representative as well as other members of the United States Delegation to the 1962 Conference, specifically supported Resolutions 8, 12 and 13 of the final Act of 1962. These obligate the signatories to the Act to (1) encourage the development and installation of efficient oil-water separators for use in ships and the preparation of an international performance specification for such separators (Resolution 8); (2) continue research on prevention of oil pollution (Resolution 12); and, (3) encourage the exchange of information among countries for the coordination of research (Resolution 13).

A program has been initiated for provision and installation of sewage treatment equipment in its new facilities and research concerned with the prevention of oil pollution has been sponsored. As reported through the Interdepartmental Committee, this program comprises:

1. Nineteen aerobic type treatment units currently being installed in vessels under construction.

2. Provision made for common soil line connections and space for sewage treatment plants on twenty-two vessels under recent construction and for all new construction.

3. A research contract for the development of a marine oil-water separator system employing the principle of static coalescence.

4. A research contract for the development of a rapid and automatic means of monitoring oil concentration in water.

5. A research contract for a compact, low cost, oil-water separation system, using standard proprietary equipment, to meet current international oil discharge requirements of 100 parts per million.

6. Requiring, where feasible, the installation of clean water ballast tanks in its new ship construction program.

7. Decision not to install sewage treatment equipment on any reserve fleet vessels now operated by the Military Sea Transportation Service in the Viet Nam supply operation because of the age and interim service of the vessels.

The U.S. Navy's program for shipboard waste disposal is outlined briefly in the following paragraphs.

Representatives from the Navy's Bureau of Ships and Bureau of Medicine and Surgery participated in an interagency committee convened by the U. S. Public Health Service to explore the problem of shipboard wastes from ships and to develop uniform treatment standards. Establishment of such standards depending upon their routes and ports of call. The major result of the committee's activities was the development of the proposed amendment to the Interstate Quarantine Regulations.

To fully understand the impact of these proposed requirements on ship design, a brief review of conventional naval shipboard sewage systems and the peculiarities of shipboard plumbing is in order.

Except in a small number of cases, all waste drainage systems are gravity systems discharging directly overboard with minimum internal piping. There are a number of reasons for utilizing this design concept such as weight and space conservation, minimum leak and stoppage risk and damage control consideration. This concept does impose on the naval architect space allocation restrictions in keeping sanitary facilities sufficiently above the waterline to permit gravity drainage.

Since modern naval warships must be designed to sustain prescribed damage and maintain mission capabilities, the damage control features of all systems are important design consideration. Drainage systems are no exception. Therefore, it is essential that penetrations of watertight decks be kept to a minimum and main watertight bulkheads never be penetrated. This design philosophy has led to a waste drainage system for each main watertight subdivision and, in many instances, separate systems within main subdivisions.

In developing a program to provide a satisfactory solution to the naval shipboard sewage disposal problem, existing shipboard sewage treatment systems were evaluated. The system that has found the most widespread acceptance in commercial shipbuilding circles is the extended aeration, activated sludge process. The fundamental feature of the unit is a system of continuous aeration of the organic material in an aeration chamber with no other sludge digestion required. Some gains in space and weight characteristics of this system make it unattractive for naval shipboard use. To illustrate this, the following compares the space-weight relationships for two ship types:

	Guided Missile Frigate	Aircraft Carrier
Treatment Units Required	4	22
Deck Area (FT^2)	550	4500
Weight (Tons)	30	250

In addition to the adverse penalties imposed on the ship, operating experience has indicated that treatment efficiency has been marginal and sludge holding facilities are not being recommended.

In the absence of factual data on ship sewage characteristics and treatment hardward adaptable to naval ship use, Naval Ship Systems Command (NAVSHIPS) undertook a comprehensive research and development program. The first phase of this program was a waste survey in representative areas in each of four different type ships.

The U. S. Navy Marine Engineering Laboratory, Annapolis, Maryland, conducted this survey and findings are reported in "U. S. Navy Marine Engineering Laboratory Research and Development Report 346/64, January 1965."

Using the results of the waste survey as a characteristic influent and the proposed effluent standards of the interagency committee as the treatment goal, NAVSHIPS contacted industry to develop the required system hardware.

Formal request for proposals (RFP) for this research and development effort was advertised in September 1965.

Several technical requirements unique to the shipboard environment were included in the RFP:

1. The system should be capable of intermittent operation for relatively short-time intervals and should be capable of being secured for long periods of time without degrading treatment efficiency. Means must be provided for by-passing the treatment system to discharge raw sewage overboard while the ship is at sea and the treatment system secured.

2. The physical and chemical characteristics of shipboard sewage are subject to variation depending on the flushing water. The system should be capable of meeting the effluent standards while transiting or lying in sea water, fresh water, or mixture thereof.

3. Careful attention should be given to minimizing system size and weight. Overall system height including withdrawal clearance for removal of components should not exceed six feet.

4. The system should meet all standard Navy environmental requirements including ability to operate satisfactorily at extreme temperatures, permanent list or trim and specified amounts of pitch and roll.

Eleven proposals representing an excellent cross section of industrial competence were received in response to the RFP. Assistance during the evaluation period was provided by the Federal Water Pollution Control Administration and the U. S. Public Health Service. A three phase contract was awarded in May 1966. Phase I established system feasibility by means of a laboratory model and has been approved. Phase II is scheduled for completion in July 1967 with the delivery of a full scale prototype for laboratory evaluation. Phase III, installation of the unit aboard a destroyer is scheduled for early 1968. Space and weight reservations on all new ship designs where the complement is 40 or more are being made for future installation of this unit. In addition, detailed cost and feasibility studies are being conducted for the installation of the system on existing ships.

Paralleling the large treatment system development program, the Navy has also been evaluating commercially available macerator-disinfector type units which will meet the above mentioned proposed standards for small ships and craft. This work was done by the U. S. Navy Marine Engineering Laboratory and is reported in the "U. S. Navy Marine Engineering Laboratory Evaluation Report 104/66, March 1966." Installation of such units is planned for small ships and craft in the Navy's future shipbuilding programs. Performance requirements for these units are specified in Military Specification MIL-S-24201. In addition, plans are being formulated to backfit sewage treatment plants in existing ships on a phased basis.

In summary, it is the stated policy of the Secretary of the Navy that a maximum effort will be made to incorporate environmental pollution preventive measures in the basic design of all ships, and that the Navy will continue to cooperate fully with the Federal Water Pollution Control Administration and the Department of Health, Education, and Welfare to comply with published standards and criteria relating to pollution abatement by Federal Activities.

EXHIBIT 2
Page 1

LAWS AND REGULATIONS DIRECTLY APPLICABLE TO WATERCRAFT WASTE DISPOSAL

Over a space of 75 years, the Congress of the United States has enacted laws which prohibit certain discharges of refuse and oil from watercraft into navigable waters of the Nation. Regulations have been promulgated by the Executive Departments pursuant to the provisions of other laws that prohibit the discharge of sewage, ballast and bilge waters from watercraft near domestic water intakes in the Great Lakes, bar the discharge into the waters of the United States of garbage containing meats of foreign origin, or garbage arriving in the United States aboard any conveyance. No single law or regulation deals with all aspects of pollution of navigable waters from watercraft; they are inadequate and ineffective for control of the problem as a whole although they do provide for control of many of its parts.

The salient provisions of these laws and regulations can be briefly summarized.

The New York Harbor Act of 1888 (33 USC 441-451 b) applies to the harbors of New York, Hampton Roads and Baltimore. It prohibits the discharge or deposit of refuse, dirt, ashes, cinders, etc., or any other matters of any kind except that flowing from streets and sewers in a liquid state in the waters of the harbors. Administration of this Act is under the U.S. Corps of Engineers.

The Refuse Act of 1899 (33 USC 407-409,411,419) makes it unlawful to dump refuse matter of any kind, other than that flowing from sewers in a liquid state, from any vessel into navigable waters of the United States whereby navigation may be impeded or obstructed. This Act has also been interpreted by U.S. authorities to prohibit the discharge of oil and oily wastes. Administration of this Act is under the U.S. Corps of Engineers. This Act is usually considered to be a protection for navigation rather than a prevention of littering and water pollution.

The Oil Pollution Act of 1924 (33 USC 431-437) prohibits the discharge of oil into or upon the coastal navigable waters from any vessel, except under certain emergency conditions, using fuel oil as fuel for the generation of propulsion power or any vessel carrying or having oil thereon in excess of that necessary for its lubricating requirements.

The Clean Water Restoration Act of 1966, Section 211, extends protection from oil pollution to all navigable waters of the United States and places administration of the Oil Pollution Act of 1924 under the Secretary of the Interior with assistance from the U.S. Coast Guard and U.S. Corps of Engineers.

The Oil Pollution Act of 1961 (33 USC 1001-1015) implements the visions of the International Convention for the Prevention of the Pollution of the Sea by Oil, 1954. This international convention restricts the discharge of oily wastes within certain international waters. Reservations in the Convention permit U. S. statutes to apply in U.S. territorial waters.

The Federal Water Pollution Control Act (33 USC 466-466K), as amended, places basic responsibility for water pollution control in the Federal Water Pollution Control Administration. Water quality standards promulgated pursuant to the provisions of the 1965 amendment (Water Quality Act of 1965) will apply to all sources of pollution including vessels and may restrict the discharge of pollutants from vessels in the waters subject to these standards.

The Interstate Quarantine Regulations of the Public Health Service (42 CFR 72.121) restrict the discharge of sewage, ballast or bilge water from all vessels within a radius of three miles (generally) from specified potable water intakes in the Great Lakes. Extension of this protection to all potable waters intakes is under consideration.

Proposed amendments to the Interstate Quarantine Regulations would require all new vessels or vessels undergoing major conversion to be equipped with facilities to treat or retain wastes. These proposals would require:

(1) For vessels with a normal complement (passengers and crew) of 41 or more, minimum treatment should be such as to produce an effluent, without the benefit of dilution with water in addition to that required for the normal operation of contributing sanitary fixtures, with 50 mg/l or less of Biochemical Oxygen Demand (BOD), 150 mg/l or less of suspended solids, and 1,000 or less coliform bacteria per 100 ml. Facilities should be provided for the storage of excess sludge for proper ultimate disposal.

(2) For vessels with a normal complement (passengers and crew) of 40 or less, minimum treatment should consist of passing the wastes through a grinder followed by disinfection which will produce an effluent having 1,000 or less coliforms per 100 ml. without benefit of dilution with water in addition to that required for the normal operation of the contributing sanitary fixtures.

Federal Regulations, 9 CFR Sec. 94.5, prohibit the discharge of garbage containing meats of foreign origin into any territorial waters of the United States. Also, Federal Regulations, 7 CFR 330.400, require that garbage from any conveyance arriving in the United States must be disposed of in such manner as to prevent dissemination of plant pests. To comply with these regulations, all garbage must be retained aboard until it may be unloaded in port for incineration or other method of disposal as may apply to the ports visited.

Exhibit 2

Garbage should be stored aboard in sound, liquid-proof containers with tight-fitting lids. Storage containers should be of such size that they may easily be handled. Thirty gallon metal or plastic cans are recommended. The number of cans on board each vessel should be sufficient to hold all garbage which may be accumulated between ports of call. Canvas chutes tied at the bottom and similar containers which are installed for sea dumping of garbage are not permitted.

The Saint Lawrence Seaway Development Corporation Regulations (33CFR 401, 401.17 & 401.21) prohibit the discharge of sewage and other wastes from vessels within the immediate vicinity of corporation installations.

Federal Regulations (36CFR 3.17-3) prohibit the draining, dumping or discharging of wastes or refuse, including human wastes, into fresh waters, except the Great Lakes, administered by the National Park Service. In salt waters and the Great Lakes, the draining, dumping or discharging of wastes or refuse, including human waste, is prohibited within Federally owned or controlled areas administered by the National Park Service and within one mile from the mean low water line of the nearest shore. All watercraft shall have waste receptacals aboard which shall be emptied only into the onshore facilities provided.

State laws and regulations specifically controlling sewage discharges from watercraft vary widely. There has been considerable discussion and effort on the part of interested boating organizations for the development of uniform state laws regulating the discharge of waste from boats. The need for uniform regulation is apparent when the mobility of recreational watercraft is considered. Not only do boats sail from one state to another, but overland transport via trailer makes the recreational watercraft fleet extremely mobile.

Despite pressure for uniform state laws, there is a wide range of requirements and permissible equipment among the states. In a tabulation, the 50 states have been considered. Of these, 21 states do not regulate discharges from watercraft while the other 29 have laws or regulations. Twelve states prohibit the discharge of sewage from boats, requiring the toilet discharge to be sealed. Twenty-one states approve or prefer holding tanks; 12 approve incinerators; 15 approve or prefer macerator disinfectors. Four states require approved treatment devices but have not implemented this requirement by approving specific devices.

From this summary, and the summary of boat registration laws presented elsewhere in this report, the prospect of uniform state laws regulating waste discharges from watercraft appears remote. Yet such uniform regulations, with attendant equipment testing and approval, are needed both for water pollution control and to facilitate interstate travel and the full enjoyment of watercraft recreation.

Exhibit 2
Page 4

The regulation and control of litter or refuse from watercraft have been almost entirely a prerogative of the states. Their laws and regulations vary widely and surveillance and enforcement is equally varied. This problem is similar in many respects to highway littering and will require both cooperation from watercraft operators and ubiquitous enforcement activities to achieve its correction.

EXHIBIT 2

Summary of State Laws and Regulations Relating Specifically to Watercraft Waste Disposal

STATE	State Law or Regulation		Approved Sewage System					
	NO	YES	No Discharge	Holding Tank	Incinerator	Disinfection*	Not Specified	
Alabama	X							
Alaska	X							
Arizona		X	X		X			
Arkansas		X		X	X	X		
California		X	X	X	X			
Colorado		X	X	X				
Connecticut		X	X					
Delaware	X							
Florida	X							
Georgia		X				X		
Hawaii		X				X		
Idaho	X A							
Illinois		X					X	
Indiana		X	X	X				
Iowa	X			P				
Kansas	X					P		
Kentucky		X					X	
Louisiana	X A			P	P			
Maine	X							
Maryland	X A					P		
Massachusetts	X							
Michigan		X	X					
Minnesota		X		X	X	X		
Mississippi	X			P	P			
Missouri		X		X	X	X		

EXHIBIT 2

Summary of State Laws and Regulations Relating Specifically to Watercraft Waste Disposal

STATE	State Law or Regulation		Approved Sewage System					
	NO	YES	No Discharge	Holding Tank	Incinerator	Disinfection*	Not Specified	
Montana		X	X	X				
Nebraska		X					X	
Nevada		X					X	
New Hampshire		X		X	X	X		
New Jersey		X	X					
New Mexico	X A							
New York		X		X		X		
North Carolina		X		X	X	X		
North Dakota	X							
Ohio		X	X	X				
Oklahoma		X		X		X		
Oregon		X	X	X				
Pennsylvania	X A							
Rhode Island	X							
South Carolina	X A							
South Dakota		X				X		
Tennessee		X		X	X	X		
Texas		X	X	X				
Utah		X			X	X		
Vermont		X		X		X		
Virginia	X A							
Washington	X A							
West Virginia	X							
Wisconsin		X	X	X	X			
Wyoming	X							
TOTAL	21	29	12	21	12	15	4	

EXHIBIT 2
Page 7

Summary of State Laws & Regulations Relating Specifically to Watercraft Waste Disposal

Notes: A - Vessel pollution may be included under general Water Pollution Control Act.

P - Device is accepted or preferred by State.

* - Usually macerator-disinfector type device.

A summary of characteristics of the existing State laws and regulations regarding pollution from watercraft are presented below.

Alabama -- Has no law relating specifically to marine waste disposal.

Alaska -- Has no law relating specifically to marine waste disposal.

Arizona -- Law prohibits the dumping, depositing, placing, throwing, or leaving refuse, rubbish, debris, filthy or odoriferous objects, substances, or other trash on any waterways or the shorelines of any waterways of the State.

Arkansas -- The State Board of Health has promulgated rules and regulations governing marine toilets and the disposal of sewage from boats. Any boat with sleeping accommodations or intended for overnight occupancy must be equipped with a marine toilet and sewage treating device or other approved system of sewage disposal. Treating devices must have an effluent coliform count not exceeding 240 per 100 ml. Requirements are also specified for incinerator type toilets. The owner of any such boat must have a permit from the State Board of Health. Other types of discharges from watercraft are controlled by the Pollution Control Commission, which also operates under the permit system.

California -- Law prohibits the discharge of sewage or industrial waste in any manner which will result in contamination, pollution or a nuisance. It prohibits the depositing or dumping of any garbage in or upon the navigable waters of the State.

Colorado -- No persons shall maintain or operate upon the waters of this State any watercraft which is equipped with a water closet unless the same is self-contained, incapable of discharging directly into the water. It shall be unlawful to deposit or discharge human wastes or other refuse into the water.

Connecticut -- Present regulations provide that no person or corporation owning or operating a waterborne craft or vehicle shall deposit or permit to be deposited a discharge of any garbage, waste matter, or refuse matter of any kind or description whatever, from such waterborne watercraft. Enforcement is by the Water Resources Commission. Two pending bills are discussed below.

H. B. 2183 would require toilet-equipped new boats manufactured or offered for sale in the State after July 1, 1968, to have the toilet equipped with a pollution control device. Chemical treatment of effluent prior to discharge into the water, or retention for onshore disposal, would equally satisfy the requirements. H. B. 3421 proposes handling pollution from vessels by regulation rather than by statute, and only on waters where a problem is determined to exist. The Boating Safety Commission, on its own initiative or at the request of the Commissioner of Health, is empowered to adopt regulations either prohibiting sewage disposal altogether or prescribing use of sanitation control devices.

Delaware -- Has no law relating specifically to marine waste disposal.

EXHIBIT 2

Florida -- Has no existing laws on boat pollution.

Georgia -- Requires treatment devices on watercraft which have marine toilets. This applies to watercraft of less than 20-ton displacement. [Act 870 (1964)]

Hawaii -- Law prohibits the throwing of refuse overboard, such as rubbish, refuse, garbage, or other substances liable to make the receiving waters unsightly, unhealthful or unclean. All watercraft maintained as residences for living purposes shall be equipped with a toilet in working condition, and all such toilets, except those on watercraft from out-of-state visiting for a period not exceeding 60 days, shall be equipped with a sewage ejector chlorinator, or other approved means of preventing pollution in harbor waters.

Idaho -- Has no specific laws or regulations pertaining to watercraft waste disposal.

Illinois - Does not have specific legislation relating to watercraft waste pollution except that the discharge of wastes from watercraft into the waters of Federal-State impoundments is prohibited.

Indiana -- Section 68-820 (1963) prohibits the operation of toilets on boats in Indiana waters except Lake Michigan. A subsequent section declares violation is a misdemeanor.

Iowa -- The State Conservation Commission of Iowa is responsible for regulations governing watercraft waste disposal. Consideration is being given to legislation requiring holding tanks. At this time, the Commission does not favor such legislation because of opposition of the Outboard Boating Association.

Kansas -- As courtesy to the Corps of Engineers, the Department of Health provides certification programs for marine toilets located on watercraft operating on Corps managed impoundments. Maceration and chlorination of the sewage prior to discharge is required for certification. A small number of boat owners have installed such required equipment, but a larger number have removed their toilets or made them inoperative.

Kentucky -- State regulations require approved treatment devices on boats with toilets. At present, the approval of these devices is only temporary pending more complete trials of various devices.

Louisiana -- The enforcement of pollution control laws are split between the State Board of Health, which is responsible for the control of sewage and toxic materials, and the Stream Control Commission, which is responsible for industrial wastes and other potential pollutants.

The only regulation relating to pollution from watercraft is in connection with the contamination of shellfish producing waters. Chaper VI of the State Sanitary Code prohibits the discharge of sewage (treated or otherwise) in shellfish producing areas.

Chapter X of the State Sanitary Code prohibits the discharge of raw sewage to any water body.

The State Board of Health is currently considering a policy statement which, among other things, would prohibit watercraft with toilet facilities from small water supply reservoirs, unless the vessel has facilities to hold all sewage, and there are adequate shore based facilities to receive the sewage. Few cities and parishes in Louisiana take their water from surface reservoirs, but those that do generally prohibit by local ordinance vessels with toilet facilities from the reservoirs.

One State Board of Health official felt that the State's existing legislation was not effective, and was not being enforced primarily due to a manpower shortage.

The Stream Control Commission has only general laws which are utilized to control pollution from watercraft. They are primarily concerned with discharge and spillage of oil or other petroleum products. Although pollution from watercraft is covered by law, the lengthy enforcement procedures virtually nullify their effectiveness.

Maine -- Has no law relating specifically to marine waste disposal.

Maryland -- Laws refer to sources of pollution generally; however, an anti-litter law is specifically directed at watercraft.

Massachusetts -- Existing legislation prohibits the discharge of any wastes from any sources on the waters of the commonwealth which would violate adopted water quality standards.

Michigan -- Laws are specific in prohibiting garbage, oil, and refuse dumping from watercraft 25 feet or more in length. The disposal of such wastes from smaller watercraft and the disposal of wastes from marine toilets could be prosecuted under the State's general health laws. Current thinking is toward permissive use of suitable waste treatment devices.

Minnesota -- Laws permit the use of marine toilets equipped with a suitable treatment device. Registration is contingent upon certification that watercraft with marine toilets are equipped with an acceptable device. The State also prohibits the discharge of other wastes and the abandonment of containers holding sewage or other wastes which might create a nuisance, health hazard, or water pollution.

Mississippi -- Has no existing legislation. However, the Pearl River Valley Water Supply District requires that holding tanks be used in conjunction with marine toilets in craft operated on its waters and also prohibits overboard disposal of "garbage and refuse."

Missouri -- Law provides that any boat with a marine toilet must have a treatment device capable of producing an effluent meeting the following minimum standards:

1. Be free of unsightly floating solids.
2. Contain a most probable number (MPN) of coliform bacteria not exceeding 240 per 100 ml.
3. Have a substantial chlorine residual present in the effluent at all times.

The law does not apply to boats engaged in interstate commerce on the Missouri and Mississippi Rivers. An official of the Missouri Water Pollution Coard indicated that the law was not being enforced due to the uncertainties of the treatment devices commercially available.

Montana -- In 1965, Monaana passed a law requiring all watercraft with toilets to use holding tanks, or treatment devices capable of accomplishing the equivalent of secondary treatment as defined by the State Board of Health which has established the following effluent standards for boat sewage treatment devices:

(a) Free of unsightly floating solids.
(b) Have 80 percent of the 5-day 20°C biochemical oxygen demand and 95° percent of the settleable solids removed from the untreated wastes.
(c) Contain a most probable number (MPN) of coliform bacteria not exceeding 240 per 100 milliliters.

Sewage retaining tanks which have no provision for discharge of sewage contents into the water are acceptable.

Nebraska -- Law requires all watercraft equipped with kitchen or toilet facilities to handle and treat solid and liquid wastes in a manner that will prevent water pollution. No waste or waste container shall be placed, left, or discharged in or near any waters of this State.

Nevada -- Law requires that boats equipped with marine toilets shall also be equipped with a suitable treatment device so that no inadequately treated sewage may be discharged into the waters of the State at any time, nor shall any container of inadequately treated sewage be placed, left, or discharged in or near any waters of this State by an person at any time whether or not the owner, operator, guest, or occupant of a boat.

New Hampshire -- The present laws require a treatment device to be attached to any marine toilet so that no inadequately treated sewage may be discharged from any boat into/or near State waters.

An amendment proposed in H. B. 3 now before the Legislature would prohibit discharging from an approved treatment system at any marina, pier, or dock or within 500 feet of any shoreline. H. B. 142 would prohibit the use of any boat toilet permitting sewage discharge to be used. Only holding tanks that pump into an on-shore sewage disposal system would be acceptable. The compliance date would be January 1, 1969, if adopted.

New Jersey -- Law provides that no toilet-equipped watercraft can be licensed to operate on non-tidal waters as long as any matter that might pollute the water, harm fish or wildlife, or litter the water or shoreline, can be discharged from its facility.

Pending legislation, S. 73,would extend the present non-tidal law to include tidal waters. It would require boat toilets to be equipped with an operating chlorinator or other sewage disposal system meeting the requirements of the State Department of Health. S. 147 would prohibit pollution from boats in both tidal and non-tidal waters of the State. It is patterned after the Model Act and would take effect January 1, 1969, if adopted.

New Mexico -- Has no existing or pending legislation covering pollution from watercraft although an administrative decision of the New Mexico Department of Public Health permits no discharge from watercraft into the waters of the State.

Local regulations prohibit all boats from water supply reservoirs, except Lake Farmington where motorless boats are permitted.

EXHIBIT 2

New York -- Law passed August 1, 1966 is contained in Chapter 897 Section 33-C of the Laws of New York. The act amended the navigation law in relation to regulate the disposal of sewage from watercraft and marinas and prohibit the littering of waterways. The Department of Health can withhold the issuance of a boat registration certificate if an approved pollution control device has not been installed on the marine toilet. Marinas are required to provide facilities to handle litter and other wastes.

Pending legislation would amend the 1966 law by deleting specific references to the coliform content of the chemical treatment macerator device, deleting references to the kind of material to be treated, and changing the wording of that portion pertaining to marina operations to eliminate the specific requirement that a marina handle sewage from holding facilities

North Carolina -- Law covers all waters in general and becomes specific only for watercraft operating on inland lakes.

North Dakota -- Has no specific regulations regarding pollution from watercraft.

Ohio -- Annotated Code (1964) Section 6111-03 prohibits the use of marine toilets except on the main stem of the Ohio River, the Muskingum River, and Lake Erie. A subsequent section declares a schedule of fines for violators.

Oklahoma -- The State Board of Health has recently adopted "Reservoir Rules and Regulations" which specifically govern the use of marine toilets on Oklahoma Reservoirs. Marine toilets are not permitted on boats operated on reservoirs of less than 3,000 acres of surface area, or less than 10,000 acres when the reservoir is used for a municipal water supply. On reservoirs where marine toilets are permitted on boats, the boat must be equipped with either a holding tank or a treating device to include a grinder and chlorinating unit and have a coliform organism concentration of 240 per 100 ml or less in the effluent.

The depositing of litter to reservoirs is prohibited. A number of other pollution control laws, although not specifically for watercraft, cover the disposal or spilling of any type of polluting substance.

A State Board of Health official felt that the rules and regulations will be effective as boats will be inspected for compliance when they are inspected for licensing and safety.

Municipally owned and operated water supply reservoirs have ordinances covering pollution from watercraft. Some prohibit all boats from such reservoirs.

EXHIBIT 2

Oregon -- The Oregon Legislature Revised Statutes (ORS 449.150) becomes effective September 1, 1967. It provides for the abatement of all sewage and garbage pollution sources including houseboats, moorages, marinas, and other waterbased buildings and structures. In addition, the Oregon State Marine Board regulates the use of marine toilets on eight lakes in Deschutes County. Toilets must be sealed, or provide treatment "to render waste harmless."

Pennsylvania -- Section 4.25 of the Motor Boat Regulations states: "No person shall dump, deposit, throw, spill or leave refuse, trash, rubbish debris, or odoriferous objects or substances, oil, or gasoline on any waterways or the shorelines of any waterways of the Commonwealth." Violation of this regulation is punishable by a fine of $5 to $100.

Rhode Island -- Has no law relating specifically to marine waste disposal.

South Carolina -- Law refers to all sources of pollution and could include watercraft by implication.

South Dakota -- Every watercraft equipped with kitchen or toilet facilities shall be equipped and operated so as to handle or treat liquid and solid wastes in a manner that will prevent pollution of the receiving waters.

Tennessee -- Code annotated Section 70-301 to 70-319 states generally that treatment devices or holding tanks must be used in conjunction with marine toilets. Some effluent standards are listed e.g., effluent must be free from unsightly floating solids; it should not exceed a total coliform count (tube detection or membrane filter) of 240/100 ml.

Tennessee H. B. 230 amended Section 39-4503 of their code to prohibit overboard disposal of refuse, trash, etc.

Texas -- In June, 1966 the State Board of Health adopted "Rules and Regulations covering Disposal of Wastes from Watercraft," which state that any watercraft equipped with a marine toilet must have a holding tank with the contents thereof to be disposed at shore-based installations. The disposal of refuse to waters of the State is also prohibited. As the rules and regulations are enforced by local Health Officers, the State Department of Health had no knowledge at this time as to whether or not the rules and regulations are being enforced. They have been in effect since June 1966. The disposal or spillage of oil, chemicals, or other pollutants from watercraft is covered under general laws and regulations.

Utah -- The operator of any watercraft shall not allow untreated sewage to be discharged or deposited in the waters of this State. Such sewage shall be properly chlorinated or incinerated prior to discharge or stored in a holding tank for disposal in an appropriate receptacle ashore.

Vermont -- Has no specific law against pollution from boats, however, control is exerted through the stream classification program. 10 VSA, Section 903--All lakes and ponds, 20 acres lying entirely within the State, are Class B waters (suitable for bathing and water supply with treatment). Raw waste discharge from boats would contravene this standard. 24 VSA, Section 2201--Prohibits deposition of litter in any waters of the State.

Virginia -- Law refers to all sources of pollution and could include watercraft by implication.

Washington -- Has no specific laws or regulations pertaining to watercraft waste disposal.

West Virginia -- Has no laws directed specifically at pollution from watercraft.

Wisconsin -- Since April 1, 1965, Wisconsin law requires the use of a holding tank. In Jun 1966 Wisconsin adopted a new law relating to control of water pollution. No change was made in the existing law related to watercraft pollution.

Wyoming -- Has no specific regulations regarding pollution from watercraft.

Exhibit 3

BASIS FOR COMPUTING WASTE LOADS

HUMAN WASTES

Pollution loads imposed on receiving waters by human waste discharges from watercraft are based on the average occupancy rate (similar to population equivalent). This method of calculation brings waste loadings from the many types of watercraft and watercraft uses to a common base. The rationale for this method is widely used. Basically, it multiplies the number of persons involved by the number of hours per year each occupies a watercraft equipped with toilets and divides this number of man hours by the number of hours in a year to develop the average annual occupancy rate.

Table I summarizes the calculated average occupancy rates for several categories of watercraft use. In using this table, it should be noted that the pollution figures are estimated potentials only and that the potential may not be fully realized in some cases. It should also be recognized that small and miscellaneous use watercrafts have not been included. While these watercraft do contribute to pollution, there is no known rational basis for estimating their pollution potential at this time.

The total human waste pollution potential from watercraft is estimated to be equivalent to just over 500,000 persons, comparable to a city the size of Cincinnati, Buffalo or San Diego. It is a ubiquitous and growing headache which, left unchecked, could become one of tomorrow's major problems. Local estimates of pollution from watercraft range from 0.2 percent of the drainage basin population to as high as 1 to 5 percent in certain locations. Comparing this overall national estimate of pollution potential with local estimates indicates that the national estimate is within the range of local estimates and gives a considerable degree of confidence that it is a realistic and rational estimate.

TABLE I

WASTE LOADS OF WATERCRAFT - HUMAN WASTES

Category	Occupancy Rate Man years/year	Percent of Total
Commercial		
Foreign Commercial-Cargo & Tanker	105,900	20.6
Foreign Commerical-Passenger & Combinations	6,100	1.2
Inland-Intercoastal	53,000	10.3
Great Lakes-Domestic only	9,200	1.8
Coastwise-Domestic	24,800	4.8
Total Commercial	199,000	38.8
Recreational Watercraft	170,000	33.1
Military - Government		
U. S. Navy	134,200	26.1
U. S. COE	2,900	0.6
U. S. Coast Guard	6,600	1.3
U. S. Mar. Ad. (MSTS)	700	0.1
Total U. S. Government	144,400	28.1
GRAND TOTAL	513,400	100.0

EXHIBIT 3
Page 2

Exhibit 3

Waste Loadings of Recreational Watercraft

Recreational watercraft comprise the largest number of watercraft of any category -- many times larger in fact than all government-owned and commercial watercraft combined. Estimating the number, size and water pollution contribution of these units is difficult as firm surveys and statistics on this aspect of recreational boating are not readily available.

Under the Federal Boating Act of 1958, the States have the right to register boats in their waters. If this option is exercised, a State is obligated to register boats of more than 10 horsepower that are used in Federal waters of that State. State registration laws may go beyond this requirement, but they must be approved by the Coast Guard in order to comply with the Federal law. By July 1966, 46 States were numbering boats under approved systems, but 24 of these reportedly had not registered all boats that come under their laws. The Coast Guard, at this time, is the numbering agent in the remaining four States and the District of Columbia, Guam and Puerto Rico, but it numbers only those boats of more than 10 horsepower which are on Federal waters.

Of the 46 States with approved systems, three have laws that cover registration of all watercraft. Twenty number all motorboats (irrespective of horsepower) and 13 number all motorboats over 10 horsepower (New Jersey is counted twice in this tally because this State numbers all motorboats on non-tidal waters but only boats over 10 horsepower on tidal waters). Four States number motorboats of 10 or more horsepower, and one numbers all motorboats over 7 1/2 horsepower. Three States require the registration of only motorboats of more than 5 horsepower; another 5 or more horsepower. One State registers motorboats of 3 1/2 or more horsepower.

Table II shows the number of boats registered in each State and the District of Columbia, according to the U. S. Coast Guard. These statistics indicate that there are, in all, 4,138,140 registered boats.

The boating industry, through its several trade organizations, publishes various statistics bearing on the overall pollution problem. TableIII summarizes pertinent statistics from these sources.

No statistical information is available on the number of recreational watercraft equipped with toilet facilities. The following derivation must be clearly labeled as an estimate of the pollution potential of such craft and used only as a guide to their gross pollution potential. It is estimated that more than 90 percent of the 580,000 inboard powered boats

EXHIBIT 3
Page 4

TABLE II

Numbered Recreational Watercraft

State	Boat Numbers Outstanding	Scope of Numbering System
Alabama	87,857	All motorboats
*Alaska	16,883	More than 10 hp.
Arizona	20,806	All watercraft
Arkansas	21,057	More than 10 hp.
California	341,033	All motorboats
Colorado	14,554	All motorboats
Connecticut	54,633	More than 5 hp.
Delaware	7,941	All motorboats
*District of Columbia	3,524	More than 10 hp.
Florida	145,691	More than 10 hp.
Georgia	69,384	More than 10 hp.
* Hawaii	7,045	More than 10 hp.
Idaho	30,488	All motorboats
Illinois	156,605	All motorboats
Indiana	135,493	All motorboats
Iowa	66,456	All motorboats
Kansas	25,391	More than 10 hp
Kentucky	45,444	All motorboats
Louisiana	69,509	More than 10 hp.
Maine	40,074	More than 10 hp.
Maryland	76,723	More than 7 1/2 hp.
Massachusetts	88,433	5 hp. or more
Michigan	398,608	All motorboats
Minnesota	211,630	All watercraft
Mississippi	36,419	More than 10 hp.
Missouri	59,725	More than 10 hp.
Montana	12,758	More than 10 hp.
Nebraska	21,278	All motorboats
Nevada	19,268	All motorboats
*New Hampshire	5,733	More than 10 hp.
New Jersey	120,090	More than 10 hp.
New Mexico	10,119	10 hp. or more
New York	393,441	All motorboats
North CArolina	66,470	More than 10 hp.
North Dakota	9,122	10 hp. or more

*States not having a Coast Guard approved boat numbering system as of 31 December 1965.

Cont'd next page.

EXHIBIT 3
Page 5

TABLE II

State	Boat Numbers Outstanding	Scope of Numbering System
Ohio	154,741	All watercraft
Oklahoma	83,484	All motorboats
Oregon	63,049	More than 3 1/2 hp.
Pennsylvania	106,687	All motorboats
Rhode Island	20,143	All motorboats
South Carolina	52,022	10 hp. or more
South Dakota	11,608	More than 6 hp.
Tennessee	70,933	More than 10 hp.
Texas	207,469	More than 10 hp.
Utah	17,140	All motorboats
Vermont	18 ,453	All motorboats
Virginia	56,773	10 hp. or more
*Washington	96,719	More than 10 hp.
West Virginia	10,044	More than 5 hp.
Wisconsin	268,829	All motorboats
Wyoming	7,170	More than 5 hp.
*Guam	181	More than 10 hp.
*Puerto Rico	2,486	More than 10 hp.
Virgin Islands	524	All motorboats
U. S. Total Known to Coast Guard	4,138,140	

*States not having a Coast Guard approved boat numbering system as of 31 December 1965.

Table III

Recreational Watercraft Statistics

40,370,000	persons participated in recreational boating, making use of the waterways more than twice during 1966
8,074,000	total number of recreational boats in existence on all waters of the United States. This total is made up as follows:

580,000	inboard motorboats in use on all waters of the United States, including auxiliary powered sailboats and boats documented by the U. S. Bureau of Customs. This figure includes 38,500 inboard boats sold in 1965.
4,698,000	outboard boats in use.
546,000	sailboats without inboard power, on all waters.
2,250,000	rowboats, canoes, dinghies, prams and other miscellaneous craft in use. Many of these are used with outboard power.

4,200	houseboats in existence. 1,250 houseboats sold in 1965.

OUTBOARD BOATS

Year	Total Number of Boats Sold	% more than 16.5' long	Number sold* more than 16.5' long	Inboard-outdrive boats sold
1966	266,000	20.5	54,000	32,000
1965	250,000	20.6	52,000	17,000
1964	250,000	19.8	50,000	12,000
1963	245,000	22.5	55,000	8,000
1962	239,000	17.0	41,000	
1961	237,000	18.9	45,000	
1960	294,000	12.2	36,000	
1959	329,000	8.4	28,000	
Total	2,110,000		361,000	69,000

2,686,000* outboard boats in use but sold before 1959

*This information calculated using these published statistics.

NOTE: These statistics selected from statistical information prepared by the editors of "The Boating Industry," and information prepared jointly by the National Association of Engine and Boat Manufacturers and the Marketing Department of the Boating Industry Association. Both publications indicate that all industry figures are estimates.

and the 69,000 inboard-outdrive boats are equipped with toilet facilities. It is further estimated that 50 percent of the sailboats without auxiliary power and 80 percent of the outboard boats of more than 16.5 feet length are equipped with some form of toilet facility. To develop the total number of outboard boats of more than 16.5 feet length, it is necessary to estimate the percentage of such boats sold prior to 1959. For this estimate, the figure of 10 percent has been selected as realistic. Table IV shows the estimated number of watercraft in each category having toilet facilities.

Table IV

Watercraft Having Sanitary Facilities
(Estimated from Industry Data)

522,000	inboard powered boats	(580,000 x 0.90)
62,000	inboard outdrive boats	(69,000 x 0.90)
273,000	sailboats	(546,000 x 0.5)
289,000	outboard boats sold from 1959-1966	(361,000 x 0.80)
215,000	outboard boats sold before 1959	(2,686,000 x 0.10 x 0.80)
1,361,000	Total recreational watercraft with sanitary facilities	

To check the above estimate, another calculation has been made using data collected by the United States Coast Guard and the Bureau of Customs. These data indicate that there are 4,138,000 numbered recreational watercraft in the United States and that 31.19% or 1,291,000 of these are 16 feet or greater in length. If 80 percent of these craft are equipped with toilet facilities, some 1,033,000 numbered recreational watercraft are so equipped. To this number must be added the 12,000 documented yachts listed in the Bureau of Customs statistics and the unpowered sailboats.

Table V

Watercraft Having Sanitary Facilities
(Estimated from Coast Guard Data)

1,033,000	powered recreational watercraft
12,000	documented yachts
273,000	sailboats
1,318,000	TOTAL

There is a close correlation between the number of recreational watercraft estimated to have toilet facilities from industry data and from Coast Guard data. Hence, an average of these estimates or 1,340,000 recreational watercraft equipped with toilet facilities will be used in further calculations.

One detailed study of the movements of recreational watercraft in and out of a marina observed 6,830 trips by boats greater than 15 feet in length. On these trips, the recreational craft carried a total of 24,459 passengers and remained away from port more than 38,600 total hours. From this study, it would appear that the average recreational watercraft carries 3.59 passengers, is away from port 5.66 or more hours per trip and results in an occupancy rate of 20.3 man hours per trip. The frequency of recreational watercraft use was not determined in this study. However, an average of two and one half uses per week during a 22 week boating season appears reasonable. This usage rate does not include day or overnite stays aboard watercraft in port or the extended boating season of the Southern United States and therefore is considered to be quite conservative. If the 1,340,000 recreational watercraft with toilet facilities receive this degree of usage it would result in an average occupancy rate for all recreational watercraft of 170,000 man years per year, comparable to the occupancy rate of a sizable city.

The use of occupancy rates and comparing them with cities must be done with considerable caution. The population of a city is fixed and relatively constant from day to day and week to week while recreational watercraft use tends to be concentrated on weekends, holidays and at vacation periods. The time and location of recreational watercraft use concentrations coincide generally with water contact sport uses, thereby increasing health hazards and aesthetic disturbances caused by pollution from this source. Weather conditions also have a considerable effect on watercraft usage, restricting it during foul weather and encouraging it during fair weather. Hence, it should be considered that while the average pollution potential of recreational watercraft is approximately equal to 170,000 people, the pollution potential on a foul-weather day during the middle of the week in the winter season may be almost zero while the pollution potential on a holdiay weekend during fair summer weather may be many times greater than the figure indicated.

It is also worthy of note that the trend in recreational watercraft is toward an increasing installation of on-board toilet facilities. This trend combines with an ever increasing number of recreational watercraft in use to indicate a steadily growing pollution problem from this source.

Exhibit 3

Waste Loadings of Commercial Watercraft

In Foreign Trade

The group of vessels considered here are those of 1,000 gross tons and over engaged in foreign commerce. Vessels engaged in intercoastal, coastwise, or non-contiguous domestic trade and military and special purpose private vessels are not included.

Vessels of all nations call at American ports. They carry both passengers and cargo and may remain in any given port of call only a few hours or many days. Between their entrance and clearance through American customs, they may call at one or many ports. During their stay in waters of the United States, almost all of these vessels practice over-the-side disposal of sewage.

To arrive at a rough estimate of this waste loading, a small segment of vessels has been investigated and the information extrapolated to estimate the total sewage waste loadings.

The subsidized portion of the American Flag Fleet was selected since data on the movements, crew size, etc., for these vessels are routinely collected and analyzed by the Maritime Administration. Data relative to these vessels were made available by the Maritime Administration and have been used in conjunction with other published statistical information to derive the following estimates of waste loadings.

In 1964, there were some 312 subsidized vessels in the American Flag Fleet. Twenty-eight of these were combination vessels (cargo and passenger) which completed 380 vessel voyages and 212,807 passenger voyages. (A passenger voyage is one arriving and one departing passenger). The remaining 284 vessels were cargo-type vessels which completed 1,442 voyages during the same period.

Using Maritime Administration data on the number of crewmen aboard and the length of port stays, it is estimated that crews of the cargo vessels spent 3,093 man years aboard the 284 cargo vessels while in the United States waters. Similarly, it is estimated that the crews of the 28 combination and passenger vessels spent 1,335 man years aboard ship while in American waters.

The great difference in crew size between combination and passenger, and cargo vessels makes it desirable to estimate the waste loadings from these types of vessels separately.

During 1964, 855,000 passenger voyages were made into and out of the United States on vessels with 24.9 percent of these made aboard the subsidized American Flag Fleet on 380 voyages. Expanding the data calculated for the 380 voyages, the total passenger load would be equivalent to 1,523 voyages and the crew aboard these combination and passenger vessels would have spent 5,350 man years aboard ship in American waters.

The 284 cargo vessels in the subsidized American Flag Fleet completed 1,442 voyages while the crews spent 3,093 man years aboard ship in American waters. During 1964, 50,998 commercial vessels entered through customs into American waters. Assuming that 1,523 of these entrances were by combination and passenger vessels, the remaining 49,475 were by cargo and tank vessels. The subsidized American Flag Fleet represents about 2.92 percent of these cargo vessel entrances, and the total pollution load from crews aboard ship during stays in American waters is estimated at 105,900 man years per year.

The pollutional contribution of the passengers aboard ship is relatively minor in comparison to that of the crews. Passengers arriving aboard ship are usually ready to disembark when the ship docks and remain aboard a minimum amount of time. Passengers embarking usually board the vessel from six to ten hours prior to sailing time. Hence, if each of the 855,000 embarking passengers spent eight hours aboard ship while in American waters, this would be equivalent to 781 man years.

In Great Lakes Domestic Shipping

Domestic shipping on the Great Lakes (1962) is carried on in a total fleet of 578 Canadian and United States Flag vessels of 1,000 or more gross tons. (Foreign shipping on the Great Lakes is included in vessels in foreign trade.) The U. S. segment of this fleet is 350 vessels. The shipping season is limited because of weather to approximately 9 months of the year. Assuming an average crew of 35, the maximum potential pollution from these American Flag vessels would be equivalent to 9,200 man years per year.

Some of the vessels in the Great Lakes fleet are known to be equipped with secondary type sewage treatment devices. No statistical information is available which details the number of such units but it has been estimated that as many as 15% of the U. S. Flag carriers on the Great Lakes are so equipped.

Exhibit 3

On the Inland and Intercoastal Waterways

The inland and intercoastal waterways are used extensively for the transport of commerce. These waterways, comprising some 25,260 miles of navigable waters, were used to transport 457.5 million net tons of goods over 144.2 trillion ton miles during 1964. According to statistics released by the American Waterways Operators, Inc., 3,915 self-propelled towboats and tugs were used to move 17,000 non self-propelled barges in this transport.

The pattern of operation of these towboats and barges is such that most of them operate continuously and only a few operate on a day work basis. The industry association estimates that 80,000 people are employed in operating these 3,915 watercraft and that an average of 53,000 individuals are aboard the watercraft at all times. Hence, the pollution potential of commercial watercraft on the inland and coastal waterways is 53,000 man years per year.

In Coastwise Domestic Trade

In addition to the domestic trade carried on the Great Lakes and on the intercoastal and inland waterways, there is coastwise commercial traffic among domestic ports. This is reported as 214,000,000 tons in 1963. The number of watercraft, size of crews, stops in port or other more definitive data are not available on this trade.

For the purpose of this estimate, it is assumed that the pollution potential of this shipping is proportionate to that of the inland and intercoastal waterways transport. On this basis, the pollution potential of domestic coastwise commercial watercraft would be 24,800 man years per year.

In Commercial Fishing

The group of watercraft being considered here are those engaged in commercial fishing either on a full-time or part-time basis. In 1964, there were 11,808 documented watercraft and 64,323 undocumented watercraft in the American commercial fishing fleet. These watercraft may be based (home port) in virtually any coastal or inland navigable waters of the United States although they are principally concentrated in the coastal areas. In size, these watercraft vary from dory size (about 12 feet) to watercraft about 200 feet long. Manning requirements of these watercraft are equally varied with many thousands of boats operated by a single fisherman either full or part-time while the larger 100 to 200-foot watercraft may require about 20 men in the crew. The use of these watercraft during a calendar year will vary from as low as 25 days (Alaska salmon fishing) to the year-round operation of New England offshore trawlers. Days absent from port also may vary from a few hours (trap boats and lobster boats) to approximately 90 days (tuna seiners and tuna bait boats).

The living habits of the fishermen are about as varied as their equipment and crew requirements. In many areas, fishermen live on board the fishing watercraft during the fishing season and in some areas they use it as their home while it is docked during the off season. In other areas, watercraft of all sizes normally return to their home port in the late afternoon, and the crews go ashore to their homes.

It is estimated that there are 127,500 part or full-time fishermen in the United States. Because of the wide variation in watercraft use and living habits, no meaningful estimate of their sewage pollution potential can be made at this time. Similarly, disposal practices for fish-cleaning wastes vary widely and cannot be readily estimated. Even though numerical estimates of the pollution potential from fishing watercraft cannot be made, this source of pollution should be recognized and considered as one of the many sources of water pollution from the operation of watercraft.

EXHIBIT 3

Waste Loadings of Federally Operated Watercraft

By the U. S. Navy

At present, the U.S. Navy is operating approximately 700 vessels of all types in waters of the United States. These vessels are generally on the Atlantic and Pacific coast areas, with only a few units located on the Gulf Coast and Great Lakes. Some 253,000 men serve aboard these vessels; however, shore leave and duty outside of waters of the United States reduce the occupancy rate of men aboard these vessels in waters of the U.S. to 134,200 man years per year. Essentially, none of these vessels is equipped with sewage treatment devices.

By the U. S. Coast Guard

The United States Coast Guard operates some 404 watercraft which have the potential of producing sewage and causing or contributing to the pollution of waters of the United States. Of these watercraft, 60 which operate wholly or principally within waters of the United States have only toilet facilities while the remaining 344 have toilet facilities and other sewage producing facilities. Of these 344 watercraft, 264 operate principally or wholly within waters of the United States while the remaining 80 are ocean-going watercraft. Approximately 14,000 persons daily serve aboard these watercraft. The waste loadings from these 14,000 persons is equivalent to 6,600 persons (occupancy rate) as many of the crew spend only a portion of the 24-hour day aboard ship, and the ocean-going watercraft spend only a fraction of their time in waters of the United States.

The watercraft which have only toilet facilities aboard have a combined occupancy rate of 50, and all are equipped with macerator-chlorinator type sewage treatment units. The 264 watercraft which operate principally or wholly in waters of the United States have a combined occupancy rate of 3,600 man years per year. Forty-six of these watercraft having an occupancy rate of 522, only, and two of these watercraft having an occupancy rate of 75 are equipped with experimental secondary treatment units. One of the 80 ocean-going watercraft is equipped with sewage treatment facilities.

The waste loadings from the operation of watercraft in waters of the United States by the United States Coast Guard can be summarized as an average occupancy rate equivalent to 6,000 persons whose wastes receive no treatment, 575 persons whose toilet wastes receive disinfection and 75 persons whose wastes receive secondary treatment. The discharge of these wastes is somewhat less subject to weekend, holiday and vacation period peak loading and is somewhat less subject to weather variations than the waste loadings from recreational watercraft.

By the U. S. Corps of Engineers

The U.S. Corps of Engineers operates a total of 321 watercraft that are, or will be, equipped with sanitary facilities by 1970. Of these, 255 sewage treatment units have been, or are scheduled to be, installed in 1967. These watercraft may operate in all navigable waters of the United States and carry a total complement of 5,028 persons. The normal work cycle of these persons is such that they spend 2,900 man years per year aboard these watercraft in waters of the U.S.

As detailed elsewhere in this report, the Corps of Engineers has equipped, or is planning to equip, all of its watercraft with sewage treatment devices.

By the Military Sea Transport Service

The United States Maritime Administration operates a group of 167 watercraft to serve as transport vessels for military needs. These vessels, frequently referred to as MSTS (Military Sea Transport Service) vessels carry an average crew of 44 persons. On the basis of their operations during July and August 1966, they spend 35.8 days per year in U.S. ports. The occupancy rate from this activity in waters of the United States is equal to approximately 700 man years per year. None of these vessels is equipped with sewage treatment devices.

By other Federal Agencies

Many departments and agencies of the Federal Government operate watercraft. Of these departments, Commerce, Defense, Health, Education and Welfare, Interior, and Transportation are represented on the Interdepartmental Committee on Pollution from the Operation of Watercraft. The major Federal operations of watercraft are detailed in this report. Other Federal operations of watercraft are believed to be relatively small and to have a relatively small waste water loadings. In addition to the departments represented on the Committee, all of which operate watercraft, a telephone survey of the Washington headquarters of the several Federal departments and agencies indicated that the following also operate one or more watercraft.

Department of Justice
    Bureau of Prisons
    Immigration and Naturalization Service

Department of Agriculture
    National Forest Service
    Agricultural Research Service
    Soil Conservation Service

Independent Agencies and Commissions
    Panama Canal Company
    Federal Aviation Agency
    Tennessee Valley Authority
    Atomic Energy Commission
    Saint Lawrence Seaway Development Corp.
    National Aeronautics & Space Admin.

OILY WASTES

There are many sources of oil pollution of navigable waters, the largest being directly attributable to incidents connected with transportation. Bulk movement by tankers on the open seas and in coastal waters and by barges on inland waters constitute an immense pollution potential that is emphasized by the fact that petroleum cargo substantially exceeds the combined tonnage of all other commodities. Approximately one billion tons of crude and oil products moved on the seas in 1966* In 1965 alone, off shore (20 miles or less) the east coast of the United States, about 2.5 million barrels of crude and refined products were moved each day, while along the Gulf coast, two million barrels moved during the same period. To indicate the problems on a tanker load basis more than 5,000 tanker loads, for example, enter New York Harbor each year while about fourteen northbound tankers pass through the Florida Straits every 24 hours.

On the U. S. mainland there are approximately 100 handling terminals and 900 commercial and naval ship yards where oil can be loaded or unloaded as cargo or fuel as well as approximately 60 tank cleaning companies. These figures provide a basis for an appreciation of the potential sources of oil pollution and the areas where accidental or careless operations can cause pollution problems of considerable magnitude. The exact number of oil spills on a nationwide basis per year is not known. However, during the three year period of 1964-66 inclusive, the Corps of Engineers reported 1187 spills for the entire country of which 747 occurred in 1966, indicating a substantial increase for this year over the preceding two.

Other potential sources of oil pollutants on the seas include offshore drilling and the tankers sunk during World War II off the Atlantic and Gulf coasts. Oil off the New Jersey coast this spring is believed to have come from a sunken tanker that has finally succumbed to the ravages of corrosion and pounding of the ocean.

Cargo, tanker, passenger and military watercraft have long been recognized as a potential and, at times, actual source of oil pollution. Oil pollution can occur from the discharge of either bilge or ballast waters. Bilge waters are of an occasional nature and the oil contained therein is from miscellaneous sources, making an overall estimate of the amount of such discharge or the oil it contains virtually impossible. Information supplied by the Maritime Administration indicates the possible magnitude of oil pollution from ballast water discharges.

*The exact tonnage is unknown. This estimate is based on information from the American Petroleum Institute, the Maritime Administration, the Office of Oil and Gas, and the United Nations.

Most merchant watercraft are designed with dual service tanks, better known in the trade as "double-bottom" tanks. The tanks are located in the lowest part of the watercraft and contain the fuel oil for the voyage, salt water ballast when the fuel is used up and ballast for stability purposes, or a combination of both fuel oil and salt water ballast in various ratios. Slack tanks (partially filled) are seldom used because the free surface movement of the liquid disturbs watercraft stability. A potential source of pollution of the seas stems from the operation of mixing oil and salt water in the same tank, and the requirement to pump out the tank for re-bunkering the tank with fuel oil for the next voyage.

The C1B-type cargo watercraft is the average size of a "small" freighter, and a C4-S-1a (mariner) is the average size of a "large" freighter. The fuel and ballast tank capacities, taken directly from the capacity plans of these two designs, indicate:

Type	FO/Ballast Capacity
C1B (6797 Gross tons)	1264 Tons
C4 Mariner (9216 Gross tons)	3723 Tons
TOTAL	4987
Average ------------------	2494 Tons

Assuming that 40% of capacity would be the maximum amount of ballast ever carried, the maximum will then be 40% of 2494 tons, or 998 tons of ballast water for the average ship. This is rounded out to 1000 tons. Now, by estimating that only 1% of residual fuel is discharged with the ballast water, it is determined that 10 tons of oil is discharged.

Using the same technique as applied to freighter, but for tankers, and different factors, a T2-SE-A2 16,500 DWT tanker was selected as being average. In this instance tankers do not have double bottom tanks, so the ballast water is put in the cargo tanks. The result is as follows:

T2-SE-A2 Type	16,500 Tons (DWT)
Allowance for FO/FW	1,600 Tons
Available for Cargo	14,900 Tons
Ballast @ 40% of Cargo Tankage	6,000 Tons
Estimating 1/2 of the 1% residual fuel in ballast water - Amount	30 Tons

While the above figures represent the maximum potential oil pollution from American ships only, operating practice indicates that the actual magnitude of oil pollution from this source is considerably less.

In 1964, there were 50,998 watercraft entrances through customs into the U.S. of which 5,234 American flag and 10,682 foreign flag watercraft entered "in ballast". These statistics do not include domestic trade or military watercraft and do not distinquish between cargo and tanker types of watercraft. Using the potential pollution developed for cargo watercrafts, ballast discharges from the "in ballast" entrances are potentially 15,916,000 tons (458,000,000 gal.) of water and 159,160 tons of oil.

These figures approximate the maximum potential discharges of ballast water and oil from these 15,916 watercraft entrances. Operating practices such as discharging oily ballast water 50 or 100 miles at sea or discharging it into proper shore based treatment facilities may reduce the actual pollution discharges. Many of the remaining 35,082 watercraft entrances may discharge some ballast water during fueling or other operations, thereby contributing to oil pollution. Domestic trade watercrafts also are potential contributors. Military watercraft, it is understood, usually discharge ballast water 150 miles at sea unless such discharge would impair the safety of the watercraft.

Each of the wide variety of watercraft, including tugs and other harbor craft, ferries with their thousands of daily passengers, ocean-going merchant watercraft, ocean liners, fishing trawlers, recreational watercraft and special purpose watercraft, has a potential for causing pollution through the discharge of sewage, litter, oil and other materials. The potential for oil pollution from watercraft in a harbor depends upon the volume of watercraft traffic into and out of the harbor. Table VI shows ocean-going watercraft arrivals and departures for major ports of the United States.

As an example, the Port of New York is further analyzed. Of the 24,580 total arrivals and departures at the Port of New York in 1964, 18,682 were in the dry cargo and passenger trades and 5,098 were tankers. These include 6,625 American flag and 12,057 foreign flag cargo and passenger watercraft and 3,153 American flag and 2,745 foreign flag tanker watercraft. Ocean-going watercraft engaged in both foreign and domestic trade are included in these data. Of the watercraft which entered through Customs at New York, 252 were "in ballast". The total number of watercraft arriving in New York "in ballast" is not known.

TABLE VI

Arrivals and Departures of Oceangoing Watercraft
at Major Ports of the United States
1964

Port	Arrivals & Departures (Combined)	No. of Watercraft (Estimated)
New York	24,580	12,290
Philadelphia	13,791	6,895
Hampton Roads	11,353	5,676

Baltimore	10,734	5,367
New Orleans	10,400	5,200
Los Angeles-Long Beach	9,467	4,733
San Francisco	9,081	4,540
Houston	8,372	4,186
Seattle	4,171	2,085
Boston	4,168	2,084
Portland, Oregon	4,081	2,040

All watercraft have a potential for discharging oil or oily wastes into the waters on which they float. Fueling, bilge water discharge and similar operations, as well as ballast discharge can release oil to cause pollution. This estimated maximum potential oil discharge via ballast water from the 252 "in ballast" watercraft entrances is equivalent to 1,104 gallons of oil per day. Spread evenly over quiet water, this amount of oil would pollute more than 1,000 acres or almost 2 square miles of water. Evenly spread along a 20-foot strip of shoreline, this amount of oil would badly degrade some 10 miles of shore per month. As has been noted, not all of this potential oil pollution is realized; however, it must also be considered that these "in ballast" entrances constitute only 2 percent of the total watercraft arriving at the Port of New York, each of which has a potential for causing oil pollution.

EXHIBIT 4
Page 1

MEMBERS OF INTERDEPARTMENTAL COMMITTEE ON WATER POLLUTION FROM THE OPERATION OF VESSELS

DEPARTMENT OF COMMERCE

William G. Allen, Chief
Division of Operations
Office of Ship Operations
Maritime Administration

DEPARTMENT OF DEFENSE

Colonel Alvin F. Meyer, Jr.
Chairman of the Department of Defense
Environmental Pollution Control Committee
Principal Defense Member

Captain William R. Riblett
Director of the Propulsion, Power and Auxiliary
Systems Division of the Naval Ships Systems Command

Mark S. Gurnee, Chief
Operations Division, Civil Works
Office of the Army Chief of Engineers

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

Malcolm C. Hope, Director,
Office of Compliance and Control
Bureau of Disease Prevention and Environmental Control
Public Health Service

Richard D. Vaughn, Chief
National Center for Urban and Industrial Health
Public Health Service

Fred S. Kent, Chief
Water Supply and Sea Resources Program
National Center for Urban & Industrial Health
Public Health Service

DEPARTMENT OF INTERIOR

Ernst P. Hall, Chairman of the Interdepartmental Committee
Acting Deputy Director, Division of Technical Services
Federal Water Pollution Control Administration

Hendon M. Crane, Director
Federal Activities Coordination, Facilities Programs
Federal Water Pollution Control Administration

Exhibit 4
Page 2

DEPARTMENT OF TRANSPORTATION

Captain James B. McCarty, Jr., Chief
Merchant Marine Technical Division
United States Coast Guard

Captain J. H. LeVan
United States Public Health Service
Chief Sanitary Engineer Officer
Medical Division
United States Coast Guard

Cdr. Malcolm E. Clark, Chief
Ship Maintenance Branch
United States Coast Guard

EXHIBIT 5
Page 1

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Page 2

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